Rural Electrification Administration Telephone Engineering and Construction Manual

Baction 690 Issue No. 1 Addendum No Juna 1962

JOTAT USE OF POURS

Purpose: This addendum provides additional information for the design of cable plant in joint-use construction.

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- 6. DATA FOR POWER LINES USING OTHER THAN NO. 4 7/1 ACSR WIRE

SAG CHARTS 1 to 6 INCLUSIVE

1. SCOPE

1.01 The information herein is for use in the design of joint-us of cable weighing 1.5 pounds per foot or more. It supplement Addendum No. 2 to REA TE & CM-690, "Joint Use of Poles" whi is limited to design where the cable weighs 1.0 pound per from less.

2. GENERAL

- 2.01 The design engineer must determine the clearances and point of attachment to power poles for cables which exceed 1.0 poper foot. The solution for a specific project can be worked out graphically as explained herein. The method can be use for making rapid checks to determine whether or not the power poles will provide vertical clearances required by the NESC rules with a desired cable on them.
- 2.02 In urban areas where spans usually are 150 feet or less, it may not be necessary to use this graphic method. In such spans the power wire sags and the cable sags are considerab

less than in the long spans usually found in rural areas. In short spans the cable sags usually will exceed the power wire sags. By the use of the clearance rules stated in the following paragraphs, the required separations for these short spans can be quickly determined.

2.03 Reference should be made to REA TE & CM-630, "Design of Aerial Cable Plant" for information as to the grade of galvanizing or other coating on the suspension strand for use in areas where corrosive atmosphere exist.

3. JOINT USE CLEARANCE AND SEPARATION RULES

- 3.01 In joint-use construction certain clearance and separation rules are stated in the National Electrical Safety Code (NESC). A cixth edition of the Code was issued by the National Bureau of Standards, dated November 1, 1961, as Handbook 81. This can be purchased from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., priced at \$1.75 per copy. In those States where the fifth edition is in effect by law, it must be continued as a guide until the sixth edition is adopted. Certain States have rules that are more stringent than the NESC rules and these must be complied with. The NESC rules of the sixth edition are referred to herein.
- 3.02 The NESC rules make distinctions as to clearances and separations depending on whether the power line voltage is below 8700 volts to ground or above this voltage. One set of rules applies where the power line supports secondary power wires and a different set where it does not.
- 3.03 The rules applicable to cable on power poles which do not support secondary power wires are as follows: (See Figure 1 in TR & CM-690 which shows certain joint-use separation requirements).
 - a. For spans exceeding 150 feet, the attachment point of the strand to power poles must be at least 40 inches (for practical purposes 3.5 feet can be assumed) below the lowest power wire attachment point, usually the power neutral wire, for power lines not exceeding 8700 volts to ground and at least 60 inches if the power voltage exceed 8,700 volts but does not exceed 15,000 volts to ground.
 - b. The minimum vertical separation required at supports between the strand and grounded non-current carrying power system equipment, such as transformer cases, is 30 inches.
 - c. The final unloaded sag of a cable at 60° F. must comply with the ground clearance rules of the NESC which are stated in REA TE & CM-602. "Clearances."

- d. MESC Rule 238 h 3(c). "For spen lengths in excess of 150 feet, vertical separation at the pole between open supply conductors and communication cables or conductors shall be adjusted so that under conditions of 60° F, no wind and final unleaded sag, so supply conductor of 750 volts or less shall be lover in the span than a straight line joining the points of support of the highest communication cable or conductor, and no supply conductor of over 750 volts but less than 50,000 volts shall be lover in the span than 30 inches above such a straight line." This means the strand line of sight attachment points must be at least 30 inches below the low point in the sag of the phase wire in Figure 1, but the multigrounded neutral wire may sag below this line of sight of the strand.
- e. The initial sag of a bare strand when installed or a cable on strand must provide at least 30 inch clearance between the lovest power wire (in this case usually the neutral wire) and the strand at 60° F. with no wind for for power lines not exceeding 8700 volts to ground and 45 inch clearance if the power line exceeds 8700 volts to ground.
- 3.04 The rules applicable to cable on power lines which do support secondary wires are as follows: (See Figure 2 in REA TE & CM-690 which shows certain joint-use separation requirements.)
 - a. Same as par. 3.03a, above.
 - b. Same as par. 3.03b, above.
 - c. Same as par. 3.03c, above.
 - d. Same as par. 303d, above. However, this means in this case that the strand line of sight must be not higher than the low point of sag of the lowest secondary wire which is in the class of power wires of 750 volts or less.
 - e. The initial sag of a bare strand when installed or a cable on strand must provide at least 30 inch clearance between the lowest power wire (in this case the lowest secondary wire) and the strand at 60° F. with no wind for power lines not exceeding 8700 volts to ground and 45 inch clearance if the power line exceeds 8700 volts to ground.
- 3.05 When suspension strand is installed, it has much less sag than after a cable is placed on it. Power wires have considerable sag in long span rural construction. Consequently,

it may be necessary to attach the strand temporarily at a point below its final attachment point to prevent contact with power wires above it on the same poles until cable is placed on the strand. The temporary means of attachment can be by driving lag bolts into the poles or by placing other suitable support hardware at proper height to give temporary clearance. Washers can be placed on the bolts and the strand can be placed on the bolts between the washers and the poles. The strand then can be secured to the poles with 0.109 inch steel line wire to hold it temporarily until after the cable is supported by the strand. The strand and cable then can be raised to the throughbolts and the strand attached by three bolt clamps in the standard manner.

IN THE PREPARATION OF FIGURE 1 - POWER LINE WITHOUT SECONDARIES NO. 4 7/1 ACSR WIRES)

Figure 1 is a graphic solution for a joint-use situation in which it is assumed that the following factors apply:

- a. Ruling span 387 feet (Taformation from power company)
- b. Average span 350 feet (Information from power company)
- c. Power line voltage 8700 volts to ground (Information from power company)
- d. Power wires No. 4 7/1 ACSR (Information from power company)
- e. Cable weight per foot 1.5 lb. (Table 1 TE & CM-630, "Design of Aerial Cable Plant.") This table shows that 100-pair 19-gauge, 200-pair 22-gauge, and 300-pair 24-gauge plastic cables for aerial use weigh in the order of 1.5 lb. per foot.
- f. Power line poles 35-foot (Information from power company)
- g. Configuration of power wires on the poles. (See RD Figure 16 in REA TE & CM-690 which is the pole head configuration drawing.)
- h. Ground clearance desired 14 feet for the cable at final unloaded sag at 60° F.
- i. Storm loading district heavy

Other data required in the graphic solution, available in REA documents, include:

strand size required for 1.5 lb. per foot cable for 300-foot spant in the heavy loading district. The Sag Charts 1 and 1 in REA TE & CM-630 show that a 10M strand is required for 1.5 lb. cable for 350-foot spans in the heavy storm loading district.

strand stringing (initial) sag at 60° F. for 300-foot. This is approximately 2 feet on Sag Chart 2 herewith.

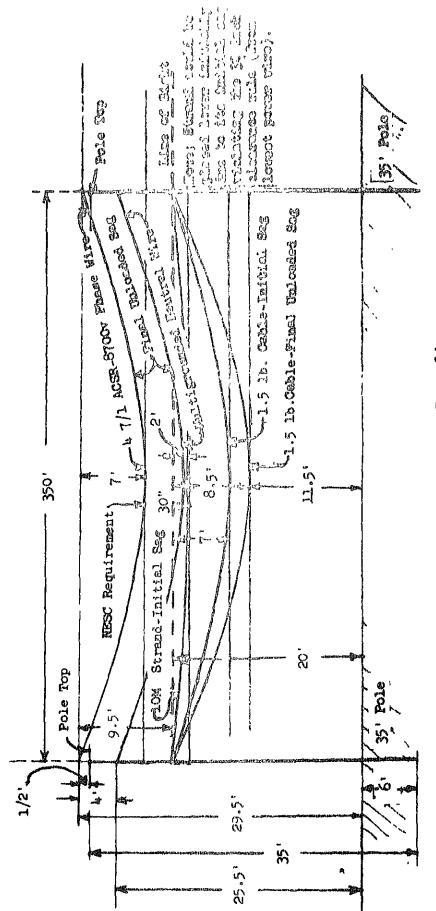
- c. The initial sag of the 1.5 lb. cable on 10M strand for 350-foot spans. This is approximately 7 feet about on Sag Chart 5 herewith.
- d. The final unloaded sag of the 1.5 lb. cable at 60° F. on 10M strand for 350-foot spans in the heavy loading district. This is approximately 8.5 shown on Sag Chart 4 in REA TE & CM-630.
- e. The final unloaded sag of the Mo. 4 7/1 ACEN power wire at 60° F. for a 350-foot span in the heavy loading district. This is approximately 7 feet as shown on Figure 8 of Addendum No. 2 to REA TE & CM-690.
- f. The attachment distance in feet above ground of the power line neutral (lowest) wire. This is shown to be 25.5 feet on RD Figure No. 16 in MEA TE & CM-690.
- \$.03 Figure 1 herewith is drawn using the rules and data presented in paragraphs 3.03, 4.01, and 4.02 above. It shows that the desired 14 foot ground clearance cannot be obtained on 35-foot power poles. Sag Chart 4 of REA TE & CM-630 shows that a cable weighing 0.75 lb. per root is the heaviest that can be used in this situation on 10M strand and still comply with the required rules as it would have the 6-foot final unloaded sag. Table 1 in REA TE & CM-630 shows that 50-pair 19-gauge, 100-pair 22-gauge, and 150-pair 24-gauge plastic cables weigh in the order of 0.75 lbs. per foot.
- 4.04 Sag Chart 7 of REA TE & CM-630 shows that the 6-foot final unloaded sag of a 1.5 lb. per foot cable on a 16M strand would provide the desired 14-foot ground clearance in this situation.
- 4.05 Figure 1 shows that the strand would require temporary location when placed because it would not clear the nautral wire by 30 inches. See paragraph 3.05.
- 4.06 In joint use on 35-foot power line poles without secondaries, the maximum final unloaded sag of a cable cannot exceed eight feet if 14-foot ground clearance is required in any storm loading district for any span length. This is based on the fact that the phase wire is 29.5 feet above ground, the neutral wire is four feet below this, and the strand attachment point must be at least forty inches (3.5 feet for practical purposes) below the neutral wire which mukes it 7.5 feet below the phase wire point of attachment. This means the strand cannot be placed higher than 22 feet above ground. The 14-foot ground

clearance leaves 8 feet for cable sag. This fact can be used as a check on the graphic solution of such problems as shown in Figure 1.

- STEPS IN THE PREPARATION OF VIGURE 2 POWER LINE WITH SECONDARIES (AND 4 7/1 ACSR WIRES)
 - Figure 2 is drawn using the same assumptions as used in making Figure 1 plus the fact that the lowest secondary wire is assumed to be 3 feet below the multigrounded neutral wire, and that an 8-foot ground clearance is parmissible instead of 14-foot which it is evident cannot be obtained here. The line of sight rule of par. 3.04 d. applies in this situation, i.e., the line of sight must be tangent to the low point of sag of the lowest secondary wire. The other data used is the same as used in Figure 1.
 - below the lowest secondary (which is the final unloaded sag of this secondary wire). This would place the strand 15.5 feet above ground, which is 14 feet below the top phase wire. The final unloaded sag of the cable which is 8.5 feet will make the ground clearance 7 feet where 8 feet is desired. A cable having a final unloaded sag of 7 feet would be the heaviest permissible for the span lengths assumed. Sag Chart 4 of NEA TE & CM-630 shows that a cable weighing 1.0 lb. per foot which has approximately 7 foot final unloaded sag at 350 feet would be the maximum size permissible on 10M strand in the heavy storm loading district. Table 1 in REA TE & CM-630 shows that 75-pair 19-gauge, 150-pair 22-gauge, and 200-pair 24-gauge plastic cables weigh in the order of 1.0 lb. per foot.
 - 5.03 To obtain 8 Poot ground clearance, the 1.5 lb. cable must not exceed 7.5-foot final unloaded sag (90 inches) or less. Use of 16M strand would be necessary. Sag Chart 7 of HEA TE & CM-630 shows that with the 16M strand the final unloaded sag of 1.5 lb. cable is approximately 6 feet which would result in 9.5 foot ground clearance.
 - 5.04 Figure 2 shows that the strand would require temporary location when placed because it would not clear the lowest secondary wire by 30 inches. See paragraph 3.05.
 - 5.05 In joint use on 35-foot power line poles with secondaries, the sum of the final unloaded sag of any kind of power wires plus the final unloaded sag of the cable cannot exceed 8.5 feet if lu-foot ground clearance is desired in any storm loading district for any span length. The top phase wire is attached 29.5 feet above ground. The lowest secondary is attached 7 feet below it or 22.5 feet above ground. The cable must be attached tangent

to the low point of secondary sag (assuming level ground). The ground clearence uses 14 feet of this 22.5 feet leaving 8.5 feet as the greatest possible sum of the secondary final unloaded sag and cable unloaded sag.

- 6. DATA FOR POWER LINES USING OTHER THAN 4 7/1 WIRE
 - 6.01 Final unloaded sag data for No. 6A and No. 6A copperweld and No. 6 ED copper power line wire are given on Eag curves in Addendum 2 to NEA TE & CM-690.

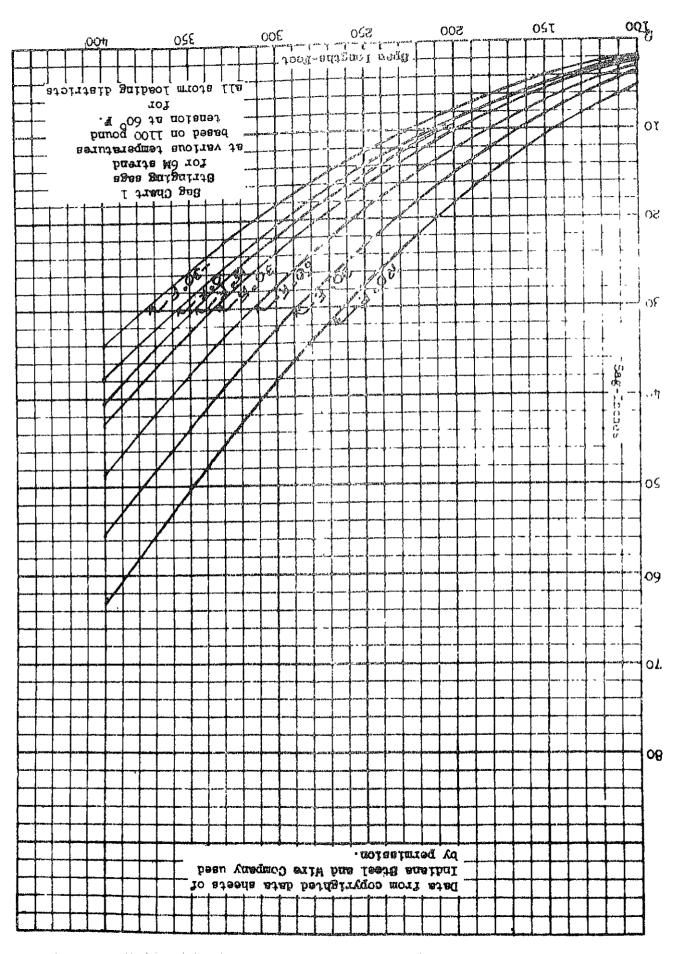


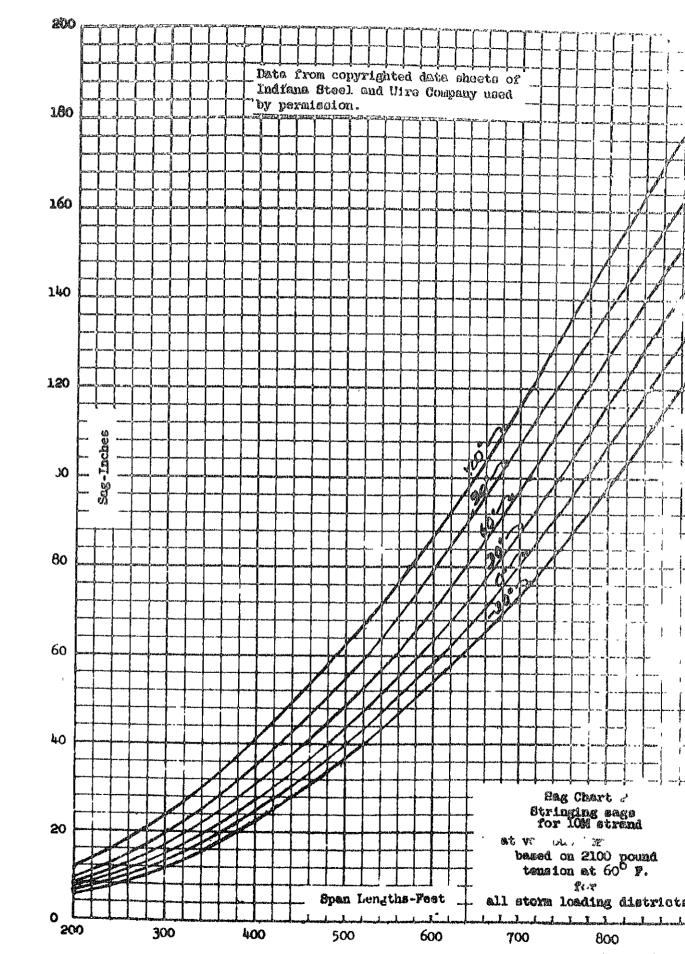
Cable in Joint Use on Power Line with no Secondaries

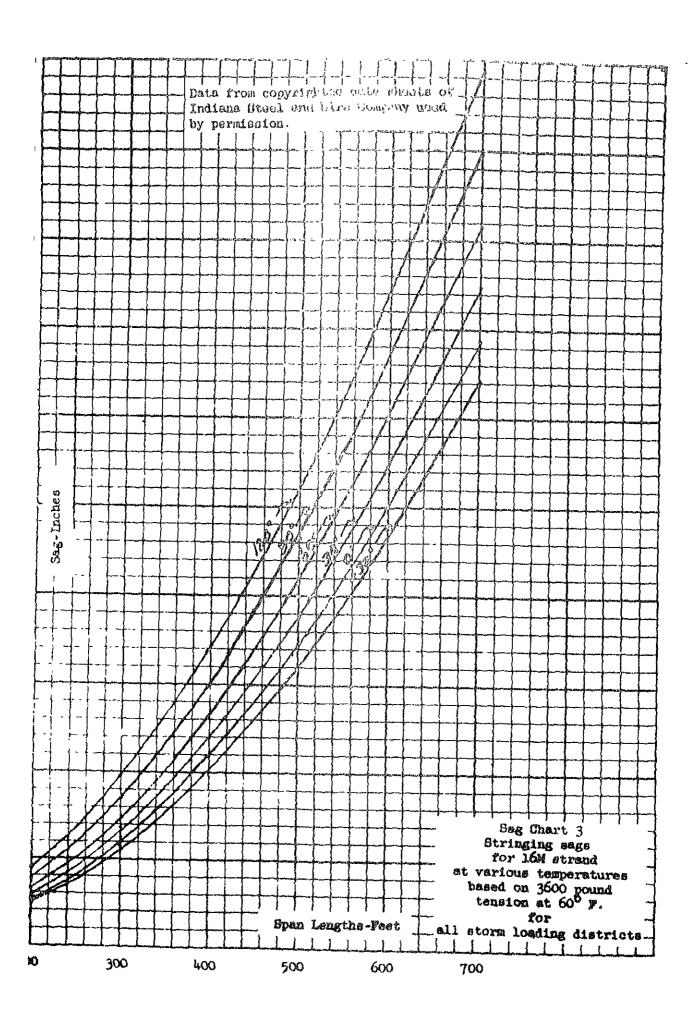
FIGURE 1

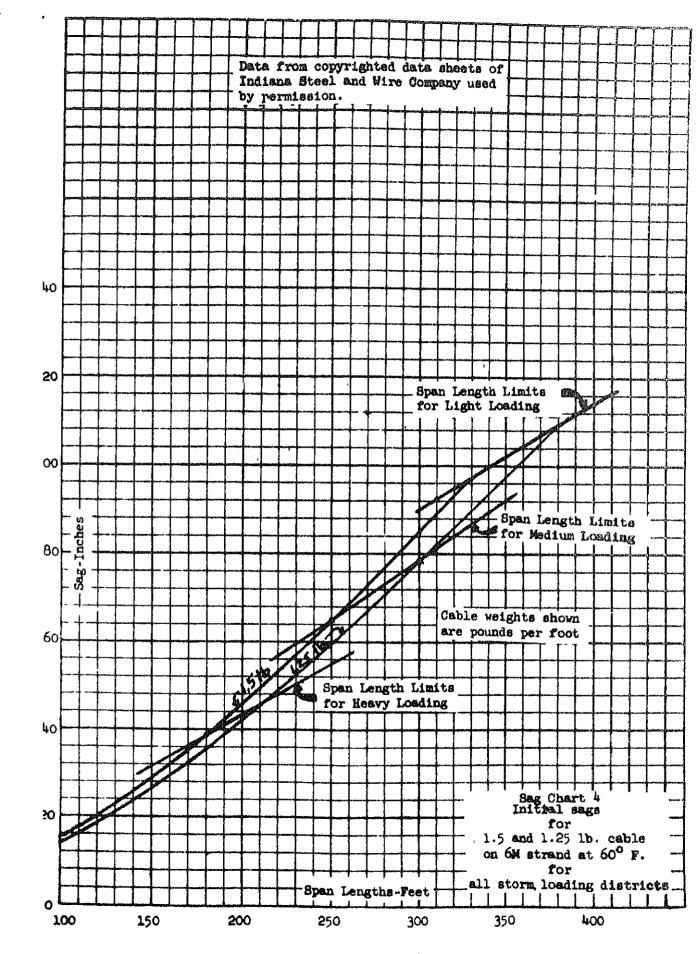
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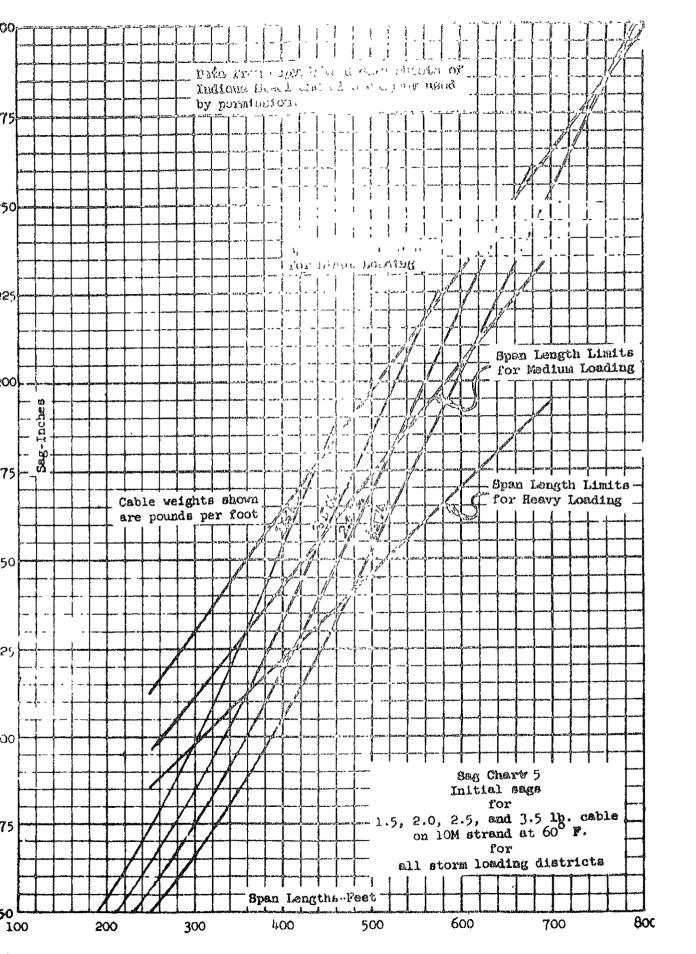
tible in joint use on fower line

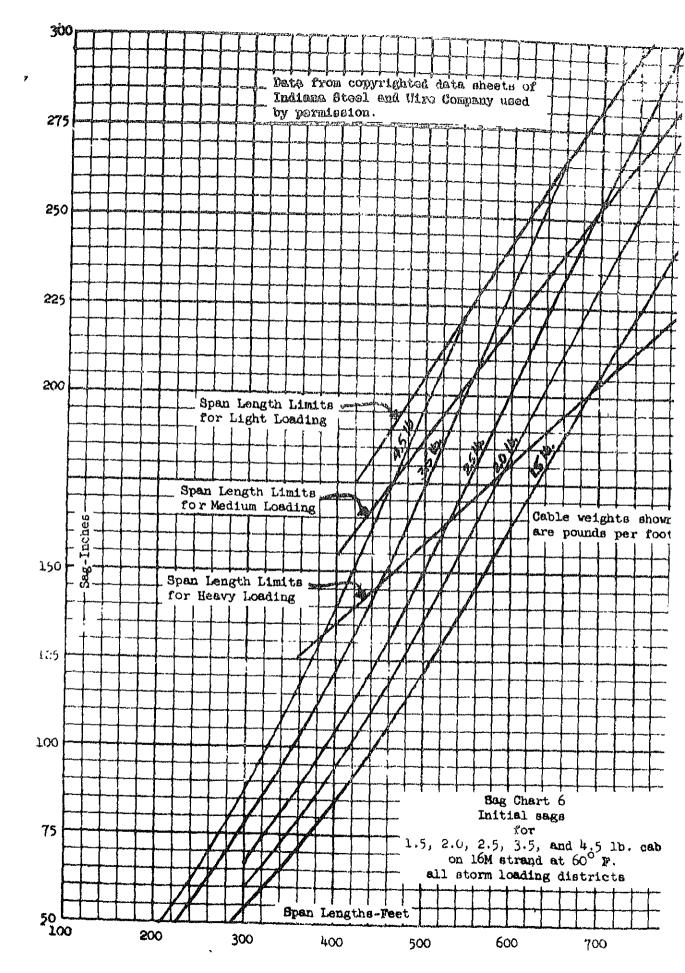












JOINT WE OF POLIS

Purpose: The purpose of this addedown is to include joint use by telephone borrowers of poles carrying 14.4/24.9 kv multi-grounded neutral type of power distribution circuits. This addendum supplements Section 690 by expanding its scope.

Additions:

1. Boops

- 1.1 This eddendum discusses considerations involved in joint use of poles for mural power and telephone circuits under conditions where:
 - 1.11 Telephone circuits are open wire.
 - 1.12 Electric power circuits are of the multigrounded neutral type whose voltage from phase to ground exceeds 8700 volts but does not exceed 15.000 volts.

2. General

- 2.1 Joint use by telephone borrowers of poles carrying 14.4/24.9 kv multigrounded neutral type of power distribution of recuits is recommended, if all requirements for such joint use as set forth below can be met and if, after careful consideration of all factors involved, joint use appears to be economically and technically desirable, or if it is the best engineering solution to difficult right-of-way or construction problems.
- 2.2 Section 690 of the TE & CM discusses the considerations involved in joint use of poles for rural power and telephone circuits involving open wire telephone circuits and multigrounded neutral power circuits whose voltage to ground does not exceed 8700 volts. It is the purpose of this addendum to set forth the considerations involved in joint use of poles involving open wire telephone circuits and multigrounded neutral power circuits whose voltage to ground exceeds 8700 volts, but does not exceed 15,000 volts. Joint use with a multigrounded neutral power system is assumed throughout the discussion that follows
- 2.3 The omission of cable construction from Issue No. 1 of Section 690 was to expedite issuance of the section and in no way implies that such joint use id not desirable. Joint use of poles for electric power circuits and telephone cables will be covered in a later addandum to this section.

- 2.4 The requirements of these education the three council and the grant on conformity with the application provides and the grant of the Matter Letter Practices for Supply and Communication Classification on were the requirements decayable devilenced for leader voltage in Paragraphs 2.2 and 2.5 of Section 550, lower voltage joint use.
- 2.5 Strongth, ground electrons and a fielding come complete mants for 14.4 kv joint very 122 has the one a as now required by Soction 650 Res I may reflere joint more.
- J. Separation Requirements Between Without the one Takendrome Changes
 - 3.1 For voltages between phone wire and navoral of 15 kg op loos, the multigrounded acreast in absentited on beding a 0-750 volt conductor. The the Charle Mayor lines of 14.4/24.9 by cycloner, the electron compractions between neutral or lowest recondery acadestors and telecan old our old the tenter within selection and the selections for single phase M.A by no trop where where 7.2 kys namely, 40 inches at the pute and of tuchos within open. Therefore the "Vertical Separation Tublon" more included in Section 690 can be used for alarge phase land by folia use. In Montana, South Daketh and Ardrena, state Laws have been passed which classify the neutral as boing frui 0-750 volts regardless of the sambor or phanes. This posmits the separation tables of Section 690 to be used ca "V" phase and 3-phase lines having a potential of 24.9 by between phases, in those three states. In other stokes, At the present time basic separations from the cultigrounded neutral or lowest secondary wire of 60 luchen at the pale and 45 inches within-span must be maintained on "Wo and 3-phase 14.4/24.9 by 11nos.

5. Electrical Protection Requirements

- 4.1 Electrical protection in this instance on in the case of joint use with power circuits not exceeding 6700 volts to ground, is based on coordinated electrical protection schemes on the power and telephone systems. The definition of "coordinated electrical protestion" is given in Peragraph 6.1, Section 690.
- 4.2 The basic telephone protection devices for 14.4 ky joint use. The use are the same as are now used in 7.2 ky joint use. The short circuit currents, recloser, characteristics, and fusing of each 14.4 ky distribution line which is being considered for joint use must be checked against the time-current characteristics of the power contact protectors which would be used on the telephone circuits. This is necessary in order to determine if they are capable of handling the probable amount of energy to which they might be subjected in the event of a contact between a power phase conductor and a telephone conductor. The time-current characteristic of a typical power contact protector is shown in Figure 2 of Section 820, Issue No. 2.

to div borres of a 14.4 by like a conserved with an equivalent 7.2 kv line supplied by substations beying equal kve ratings is roughly half that of the 7.2 kv lim ot. or mear the substation. A cross-over point is usually received asso distance out on the line, beyond which the chart circuit current of the 14.4 kv line would be greater than that of the 7.2 kv line, but loss than the value at the substation. On the substation side of the cross-over point, there is usually an edequate difference between the maximum normal load currents and foult current to make it easy to obtain reliable and positive emerction of reclosers on fault currents, vithout false operation on unusually high nonfault load currents. The duty on the nover contact protectors on the substation side of the cross-over point vould be less at 14.4 kv than on the equivalent 7.2 kv line. Therefore it is possible to handle somewhat higher ave ratings with 14.4 kv systems without exceeding the safe ourrent-carrying capacity of the power contact protectors. Beyond the cross-over point. the higher abort curcuit currents of the 14.4 kv system insure more positive operation of reclosers than is possible in an equivalent 7.2 kv system and there is little danger of burning out the power contact protectors. Although in some instances, as indicated above, the duty on the power contact protectors would be less in a 14.4 kv system than in a 7.2 kv system of the same kva rating, it is recommanded that they be installed at intervals of 20 ohms of telephone conductor (one . wire) as now specified in Section 820 of the TE & CM.

5. Blectric Induction at Fundamental Proquency

- 5.1 For the same average cross section configuration of wires, the open circuit electrically induced voltage in telephone circuits on a joint use power line would be almost twice as high in a 14.4 kv system as in a 7.2 kv system. Therefore approximately twice as many drains would be required on telephone circuits on a 14.4 kv line in order to reduce the induced voltage to the same level as that from the 7.2 kv line. While it is desirable to hold the induced voltage on all lines to the practicable minimum, there is no hard and fast limiting value of voltage that would be considered tolerable. Ringing, personnel, and economic considerations are also involved. Drainage units should therefore be installed in accordance with the requirements of Section 820.
- 6. Magnetic Induction at Fundamental Frequency Short-Circuit Conditions
 - 6.1 The current in a power fault to neutral or to ground not involving the telephone wires would still impress voltage

on the telephone wirse by a gravite induction. The regard tudes of these longitudinally-induced voltages may fixed be compared for the 16.4 to and the 7.2 kg cases on the assumption that the abort-circuit currents are the north and similarly divided between neutral and ground. If the neutral is at the seas vertical specing from the telephone conductors at 14.4 and at 7.2 kg so will normally be the case, the induced voltage will be the same in either case.

6.2 If any fault location ough that the fault current in smaller at 14.4 kv, the situation would thus favor the 14.4 kv system as against the 7.2 kv system. For femite at great distances from the substation (for which the induced voltage may still be relatively large in spite of the lowered magnitude of the fault current), the induced voltage will be higher at 14.4 kv. Large conditions will be the determining factor here. But, as a general statement, it is unlikely that abnormal magnetic induction would significently influence the choice between joint use at 7.2 and at 14.4 kv.

7. Noise

7.1 There are many factors that affect noise in circuits on a joint use line. Some of these factors are dependent on voltage, others are dependent on current. Therefore, for the same system kva rating, an increase in noise from nome sources would be expected with a 14.4 kv system as compared with an equivalent 7.2 kv system, while a decrease would be expected from other sources. The net offect of an increase in voltage would be entirely different in different situations. Therefore there is no reason to suppose that noise conditions would be materially worse in joint use at 14.4 than at 7.2 kv.

Section 690 Issue 1, Addendum 2 Juma 1959

JOINT USE OF POLEM

Purpose: The purpose of this addendum is to supplement REA TE & CM-690, "Joint Use of Foles" and Addendum 1 thereto with information required in the design of serial cable plant in joint use construction.

Additions:

1. SCOPE

1.1 This addendum discusses joint use of poles for power circuits and serial cable in rural areas. It is intended to be used in conjunction with the REA TE & CM-690 to which it is directly related.

2. GENERAL

- 2.4 In addition to construction economies the long spans commonly used for rural power circuits reduce cable maintenance costs because less bowing occurs than in short spans and less sheath trouble results as most of this trouble occurs near poles.
- 2.5 REA has established a maximum of 60 percent of the rated breaking strength of suspension strand as the limit to which the strand shall be stressed when the strand and cable it supports are loaded with ice and wind in accordance with the National Electrical Safety Code (NESC) storm loading assumptions. These loadings are stated in REA TE & CM-611, "Design of Pole Lines."

Table 1 gives the maximum allowable average spans for plastic sheath, plastic insulated cables of various weights per foot lashed to strand, in the NESC loading areas based on the 60 percent of rated breaking strength of the strand.

TABLE 1

APPROXIMATE MAXIMUM AVERAGE SPALE POR ABRIAL CABLE AND RELATED LIAMED SERVED THEBIOL

ttee Grade	Au b. 1 a	Hoavy Max	Locating Deckoral	Medius Lan.	Loading	Lami.	Loading Loading
ity Grade 1 Strand 31se	Cable Weight Lbe/Ft.	Spans Fest	Tomico	Opano Feut	Tanalon Tho.	Noot Neno	Monales Light
6ы	.25	325	3357	400	2945	400	2461
6м	.5	300	3515	400	330 L	400	285½
6ы	.75	250	31,113	350	3389	400	3148
614	1.0	250	3 692	300	3365	400	3457
101	.25	700	5053	900	5370	900	4529
104	.5	600	6 146	700	5427	700	4719
104	.75	600	6 551	700	5876	C3 U5 U2	28 EP3 404 314
10%	1.0	600	6931	700	6306	700	56.17

The use of 6M strand is not recommended for joint use in the light loading area where spans are in the order of 450 to 700 feet. This is because the effect of concentrated load at mid-span (splicer and tools), the relatively low strength of this size strand and the large sags required.

- 2.6 The final sag of cable will be greater than its initial stringing sag due to stretching of the strand due to wind and ics. The differences are ignored in urban or other short span construction but cannot be ignored in long spans because sags may vary so enach as two or more feet between initial and final conditions even with cable weighing less than 1 lb. per foot. It is not practicable to restore cable to its original cag by pulling slack after an ice storm as is done with open wire. Consequently, it is necessary to allow initially for sag increase due to storms when determining the ground clearence and when making joint pole strand attackment points so the initial sag will give the RESC required separations from the power wires in the syens and at the poles.
- 2.7 The weights of plastic cable used by FFA borrowers in aerial plant along rural roads where power line spans are relatively long will seldem exceed 1.0 lb. per foot. The data herein are limited to that required for cables not much in excess of 1.0 lb. per foot. There are many more different cable diameters and weights per foot than there are of commonly used telephone line wires. This makes it impracticable to furnish exact data for all of the cable sizes commonly used in long span construction. It is practicable to group cable sizes of approximately the same weight per foot for the purposes of this addendum, and thereby limit the number of data sheets and curves required. The data in this addendum are limited to copper conductor cables lashed to either 6M or 10M utility grade galvanized steel strand.

- 2.8 RMA power line construction in rural areas uses sage and tensions based on "ruling spans." Expressed so a formula it is: Buling Span - Average Span + 2/3 (Max. Span - Average Span). As a general rule. ANA berrowers' rural power lines sake use of one of four different power conductors. Final unloaded sag curves of these four kinds of conductors are given in Figures 8 to 16 inclusive. Final unloaded mag means the mag after the conductors have been loaded with wind and ice to the amounts specified by the NESC and the load is removed. It is necessary that the kind of power conductors and the ruling span used in the foint line he known in designing joint use for telephone cable and that the theoretical final unloaded sag of the power conductors be used when determing clearances between power and communication conductors. In aerial telephone cable construction the sag and tension data are not furnished on the basis of ruling spans but on actual span lengths on the assumption that the cable is deaderded at both ends of the span: in other words it is assumed that the poles do not lean due to the loading.
- 2.9 Cable suspension strand is placed to definite tensions depending on strand size and temperature. The tension is practically uniform from deadend to deadend in the strand when placed, regardless of span length variations. After a cable has been placed and supported by a strand, the sage will vary in spans of different lengths.
- 2.10 In checking the sag that results in a cable span after a job is finished, some variation for each different span length from the sag curve amount can be expected. The amount of the variation cannot be exactly forecast. The sag in a short span probably will be less than shown on the sag curve for a certain average span and greater for a span longer than the average. The sag would agree with the sag curve calculated value only in the case of a level section of line having exactly equal span lengths throughout.
- 2.11 Cable dancing, also called galloping, may occur where high winds prevail. Where there is the possibility of this phenomenon occurring, the cables should be spiraled around the strand immediately after placing, in accordance with instructions provided in NEA TE & CM-635, "Construction of Aerial Cable Plant." If this is not done there is the possibility of the cable dancing sufficiently to cause contact between it and the power conductor above it.
- 2.12 REA TE & CM-635 should be consulted for construction practices.
- 2.13 All applicable requirements of the NEEC should be complied with.

3. STREETH REQUIREMENTS

3.4 Longer spans could be provided by using 16M strand than with 6M or 10M but this large strand is out of proportion in size to small

cables and costs considerably more than 10M strand (about 30-35%). It is necessary to use 10M strand for small cables in extra long span construction where 6M strand would be adequate for short spans. This is because of the considerable sag that results in very long spans even with small cables if supported by small size strand.

3.5 Strand and the cable it supports can be equated in terms of bare wire for pole strength determination when using Figures RD-1 to 15 of Issue I, REA TE & CM-690, "Joint Use of Poles." The transverse load that will be added on power poles by cable lashed to strand is given in the following table of equivalents to .109 inch diameter wire.

APPROXIMATE EQUIVALENT IN NUMBERS OF 0.109 INCH DIAMETER
BARE WIRES FOR CABLE: LASHED TO 6M OR 10M STRAND
FOR USE IN COMPUTING TRANSVERSE LOADS ON POLES

•	Numbers of Wires Storm Loading District			
Diameter, Cable Only	Heavy	Medium	light	Principalis
0.5 inch	2	2	8	
0.75	2	4	12	
1.0	2	4	14	
1.25	l _k	lų.	16	
1.5	l ₄	$\mathbf{l}_{\mathbf{k}}$	18	
1.75	1.	6	20	
2.0	li	6	22	
2,25	ļi.	6	24	
2.5	4	6	28	

Note: Diameters stated are for cable only; that is, strand diameter is not included. However, the data given in numbers of bare wires is based on the cable diameter plus the strand diameter. For example, a cable 0.5 inch in diameter lashed to a 6M or 10M strand when storm loaded equates approximately to 2 bare 0.109 inch diameter wires when these are storm loaded, in the heavy storm loading district.

CLEARANCE AND SEPARATION REQUIREMENTS

Where cable is attached to power poles that also support open wire telephone crossarms, the cable should be attached to the poles under the lowest crossarm to minimize the possibility of open wires swinging against the cable strand which is grounded. The final unloaded sag of cable and strand, especially in long span construction, generally is greater than the maintenance sag for open wires in the same spans.

- 4.5 Among the MESC requirements which should be observed are those relating to the location of vertical cable runs on poles, such as for underground feeds, dips and pole mounted cable terminals and loading coils.
- 4.6 Secondaries on power poles usually are below the neutral wire and generally are of such size that they are installed with the same sag as the neutral wire. The lowest secondary is assumed to be attached to poles 3 feet below the neutral wire. The data sheets provided herein are based on these assumptions.
- 4.7 REA TE & CM-690 in paragraphs 4.31 to 4.37 states in detail the requirements for vertical separations of circuits at the supports and in spans. Briefly stated these requirements are:
 - 4.71 Minimum vertical separation at the supports between telephone

circuits and power conductors of less than 8700 volts between conductors is 40 inches. This includes separation from posstransformers.

- 4.72 Minimum verticed separation at the supports between telephone circuits and power conductors of more also 6700 volts between conductors is 60 inches.
- 4.73 Minimum vertical separation in spans between telephone circuits and power conductors of less than 8700 volts between conductors is 30 inches.
- 4.74 Minimum vertical separation in spans between telephone circuits and power conductors of more than 8700 volts between conductors is 45 inches.
- 4.75 Other requirements are that (1) telephone circuit attachmen on poles shall be adjusted so that at 60°F and no wind, no secondary (0-750 volts) shall hang below a straight line of sight between telephone circuit attachments on adjacent pol and (2) no power conductor of more than 750 volts shall be lower than 30 inches above this line of sight. This applie even though a neutral is below the power conductors. The neutral in this case is covered by paragraphs 4.71 and 4.73 above.
- 4.8 The minimum permissible ground clearance for power wires along roin rural areas under NESC rules usually is 18 feet basic, but this may be reduced to 15 feet basic where the ground under the line i will be traveled except by pedestrians.

Communication conductors (including cables) require 14 foot basic ground clearance in the same rural areas but may be 13 feet basic if not overhanging traveled portions of the road or 8 feet basic where the ground under the line will never be traveled except by pedestrians. Data herein covers basic ground clearances of 8, 10 12 and 14 feet for telephone cable and assumes 15 foot minimum powers ground clearance.

- 4.9 REA TE & CM-635 includes strand stringing tension and sag data at 20°, 60° and 100°F for 6M, 10M and 16M strands. Figure 1 herewigives strand stringing sags at 60° for 6M and 10M strand.
- 4.10 Initial sag curves at 60°F and final sag curves at 120°F for cab. weighing .25 to 1.0 pounds per foot with 6M and 10M strands are given in Figures 2 to 7, inclusive, for the heavy, medium and lilloading areas. The 120°F sag curves are given because this give the greatest sags that are likely to occur in hot weather.

CLIMING REMAN ROUTER PROPERTY

- 5.3 Where two or more cables are attached to a gover pole they shall be on the same star of the pule to comply with MMC climbing space requirements.
- 5.4 Cables preferency shall be attached to the same side of the pole as the power meteral wire.

MECTRICAL PAYESTION WESTERNAY

6.3 The requirements of Mark 12 6 Cardin, "Cable functit Protection" should be complicit with. In brief, these requirements are that cable sheaths or shields be boated to the Man of the power system via the support strand and a vertical pole ground vire (1) at the beginning and end of the joint use section; (2) at one side intervals (if the section is range than 1.5 addes in length); and (3) on every electric supply pole that carries a vertical pole ground vire to which is connected transformers, capacitors, or other types of power equipment that drew load current under normal conditions. In addition to the above grounding boats the cable shouth or shield should be electrically connected to the central office ground.

INDUCTIVE COORDINATION

7.4 REA TE & CM-45(), "Inductive Coordination - Telephone Circuit Moise Due to Induction from Electric Person Lines," should be consulted particularly as to the relative ments of cable on joint poles with power circuits versus cable on a pole line at highest separation from the power line.

ECONOMIC CONSIDERATIONS

8.5 Where more than two poles per mile require replacement or pole inserts to permit joint use for cable, the project is doubtful economically. Cost studies should be made in any swent as outlined in MMA 72 & CM-205, "Propagation of an Arma Cossauge Design," and MMA 72 & CM-218, "Plant Annual Cost Data for System Design."

SAFETY COMBUDERATION OF

9.6 Telephone lineman should not work in power space above communication space on joint use poles. Vertical pole ground wires on electric supply poles that are interconnected to transformers or capacitor banks should be connected directly to the power system neutral. The transformer or capacitor banks should also have direct connections to the power system neutral. At such locations visual inspection from the ground should be made before climbing, to escertain that the vertical pole ground wire is actually connected to the neutral. If it is not connected. This fact should be reported to

- the power company and the wire should be regarded as energized. The pole should not be touched or climbed by telephone linemen until the condition has been corrected by the power company.
- 9.7 When suspension strand is installed it has much less sag than after cable is placed on it. Power wires have considerable sag in long span rural construction. Consequently, it may be necessary to attach the suspension strand temporarily at a point below its final attachment point to prevent contact with power wires above it on the same poles until cable is placed on the strand. The temporary location should keep the strand at mid-span below the lowest power wire attached to the poles above the strand. The temporary means of attachment can be by driving lag bolts into the poles or by placing other suitable support nardware at proper height to give the temporary clearance. Washers can be placed on the bolts and the strand can be placed on the boits between the washers and poles. The strand then can be secured to the poles with .109 inch steel line wire to hold it-temperarily until after the cable is supported by the strand. The strand and cable then can be raised to the throughbolts and the strand attached by three bolt cable clamps in the standard manner.
- 9.8 The curves of sags for strand only and for strand with cable in place can be used to determine the temporary location of the strand on the poles. For example, a 6M strand when installed will have about 2.5 feet of sag in a 300 foot span at 60°F. A cable weighing .5 pounds per foot on this strand will increase the sag to nearly 5 feet. Therefore in this case the strand should be placed 2.5 feet below its final location, assuming that this point is to bring the cable at mid-span to a point 30 inches below the lowest pole attached power wire.
- 9.9 Safety considerations dictate that cables be lashed in joint use construction from the ground rather than by a man riding the strand to handle the lashing machine.
- 9.10 Strand should be grounded at all times during installation and permanently bonded to the neutral power wire immediately after stringing.
- 9.11 In long spans intermediate poles between power poles to support the cable but not the power wires create an electrical hazard and should be avoided.
- 9.12 Telephone linemen may make bonding connections to vertical pole ground wires in communication space on joint use poles. If no vertical pole ground wire exists on a pole on which a grounding bond is required, sufficient bonding wire to reach and connect the MGM shall be left coiled and taped two fest above the cable.

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CLIMATING REPORTS AND FALL COMESTICATE

- 5.3 Where two or more cables are attribut to a gover pole they shall be on the same and of the puls to comply with WESC climbing space requirements.
- 5.4 Cables partership shall be attached to the same wide of the pole as the parer neutral were.

BLECTRICAL PROTECTION HEAVIESTS

6.3 The requirements of Mak it a (M-Si), "Cable fircuit Protection" should be complete with the brief, these requirements are that cable sheaths or shields be booked to the Miss of the power system via the support strend and a vertical pole ground vire (1) at the beginning and end of the joint use metion; (2) at one mile intervals (1f the section is more than 1.5 adies in length); and (3) on every electric supply pole that carries a vertical pole ground vire to which is connected transformers, capacitors, or other types of power equipment that draw load current under normal conditions. In addition to the shows grounding baseds the cable sheath or shield should be electrically connected to the centural office ground.

LEDAKTIVE COORDINATION

7.4 RBA TE & CM-450, "Inductive Coordination - Telephone Circuit Moise Due to Induction from Electric Power Lines," should be consulted particularly as to the relative merits of cable on joint poles with power circuits versus cable on a pole line at highesty separation from the power line.

BCOSONIC CONSIDERATIONS

8.5 Where more than the poles par adle require replacement or pole inserts to permit joint was for cable, the project is doubtful economically. Cost studies should be made in any event as outlined in MMA THE & CM-205, "Propagation of an Area Coverage Design," and NMA THE & CM-218, "Plant Annual Cost Data for System Design."

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- the power company and the wire should be regarded as energized. The pole should not be touched or climbed by telephone linemen until the condition has been corrected by the power company.
- 9.7 When suspension strand is installed it has much less sag than after cable is placed on it. Power wires have considerable sag in long span rural construction. Consequently, it may be necessary to attach the suspension strand temporarily at a point below its final attachment point to prevent contact with power wires above it on the same poles until cable is placed on the strand. The temporary location should keep the strand at mid-span below the lowest power wire attached to the poles above the strand. The temporary means of attachment can be by driving ing bolts into the poles or by placing other suitable support nardware at proper height to give the temporary clearance. Washers can be placed on the bolts and the strand can be placed on the boils between the washers and poles. The strand then can be secured to the poles with .109 inch steel line wire to hold it-temperarily until after the cable is supported by the strand. The strand and cable then can be raised to the throughbolts and the strand attached by three bolt cable clamps in the standard manner.
- 9.8 The curves of sags for strand only and for strand with cable in place can be used to determine the temporary location of the strand on the poles. For example, a 6M strand when installed will have about 2.5 feet of sag in a 300 foot span at 60°F. A cable weighing .5 pounds per foot on this strand will increase the sag to nearly 5 feet. Therefore in this case the strand should be placed 2.5 feet below its final location, assuming that this point is to bring the cable at mid-span to a point 30 inches below the lowest pole attached power wire.
- 9.9 Safety considerations dictate that cables be lashed in joint use construction from the ground rather than by a man riding the strand to handle the lashing machine.
- 9.10 Strand should be grounded at all times during installation and permanently bonded to the neutral power wire immediately after stringing.
- 9.11 In long spans intermediate poles between power poles to support the cable but not the power wires create an electrical hazard and should be avoided.
- 9.12 Telephone linemen may make bonding connections to vertical pole ground wires in communication space on joint use poles. If no vertical pole ground wire exists on a pole on which a grounding bond is required, sufficient bonding wire to reach and connect the MGN shall be left coiled and taped two feet above the cable. Attachment of this wire in electric supply space on the pole and

and competion to the life must be done by purer company limmen.

D. Determination of pole interesting the line power pole lines

- 10.52 Reference should be made to the REA TE & CH-690 paragraphs under this beading. In this edicadum the vertical segmention data are given in ED Figures 64 to 98 inclusive for cable placing.
- 10.53 The following examples are provided for use in determining the practicability of joint use for cable:

Example No. 4:

Conditions:

Cable Size 25 pr., 22 ga. plastic shoath

and insulation.

Loading Matrict Essay

Cable Ground Clearence S feet

Average Span Length 300 feet

Ground Level

Power Pole Height 30 feet

Pole Class 6

Secondaries Note

Power Wires 4-7/1 ACER

Power Wire Configuration Single Place, 2 Wire

Voltage 7200 volts

Froposed Suspension Strand 6M

Ruling Span Length 325 feet

Solution:

Step 1. Cable Weight - .209 lb. per foot. Consider it to be .25 lb. per foot.

Step 2. Table 1 shows that this 25 pr. 22 gs. cable can be used on the strend for average spans up to 325 feet in beavy loading.

- Step 3. Power neutral wire point of attachment above ground on 30 ft. pole is 21 feet.
- Step 4. Power wire final seg in a 300 ft. span where ruling span is 326 feet is 3.5 feet (Figure 8).
- Step 5. Initial sag of .25 lb. per foot cable on 6M strand, 300 ft. span, heavy loading, is 3.5 feet (Figure 2).
- Step 6. Final sag of .25 lb. per foot cable on 6M strand, 300 ft. span, heavy loading is 6.0 feet (Figure 2).
- Step 7. Because the initial sag of the cable will be equal to the final sag of the power wire (3.5 ft.) the cable can be attached 3.5 feet below the power wire point of attachment. This point is 21 minus 3.5 which is 17.5 feet above ground.
- Step 8. With the cable attached 17.5 ft. above ground and final cable sag of 6.0 ft., the ground cheerance at mid-span on level ground would be 11.5 feet.
- Step 9. The attachment of the cable can be 3.5 feet below the point of power neutral attachment per Step 6 above. The cable equates to approximately 4 open wires per paragraph 3.5. The 4-7/1 ACSR power wire diameter is .257 inches (approximately .250 in.). Reference to REA TE & CM-690, RD Figure No. 2 for "2 power conductors" and "4 communication conductors" can be carried safely in 300 ft. spans by a Class 6 pole in heavy loading.

Example No. 5:

Conditions:

Cable Size 75 pr., 22 ga. plastic sheath

and plastic insulation.

Loading Area Medium

Cable Ground Clearance 8 feet

Average Span Length 350 feet

Ground Level

Power Pole Reight 35 foot

Pole Class 7

Secondaries

each!

Power Conductors

5-7/1 ACAR

Power Configuration

Single Phase, 2-wire

Voltage

7200 Wille

Proposed Strand

6м

Ruling Span Length

425 feat

Solution

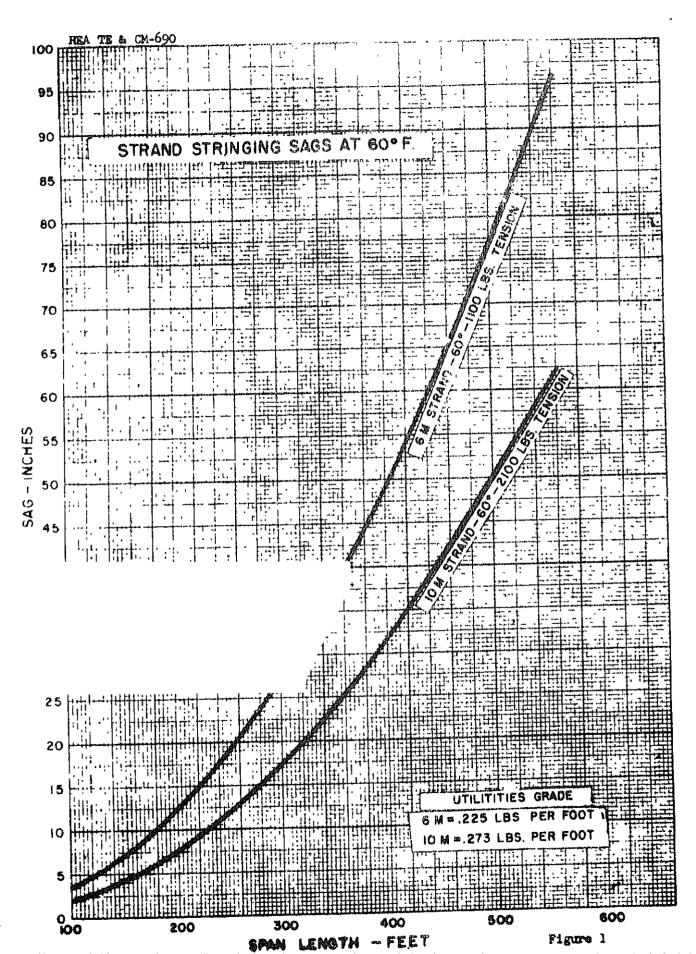
Step 1. Cable Weight = .50% lb. per foot. Consider it to be .5 lb. per foot.

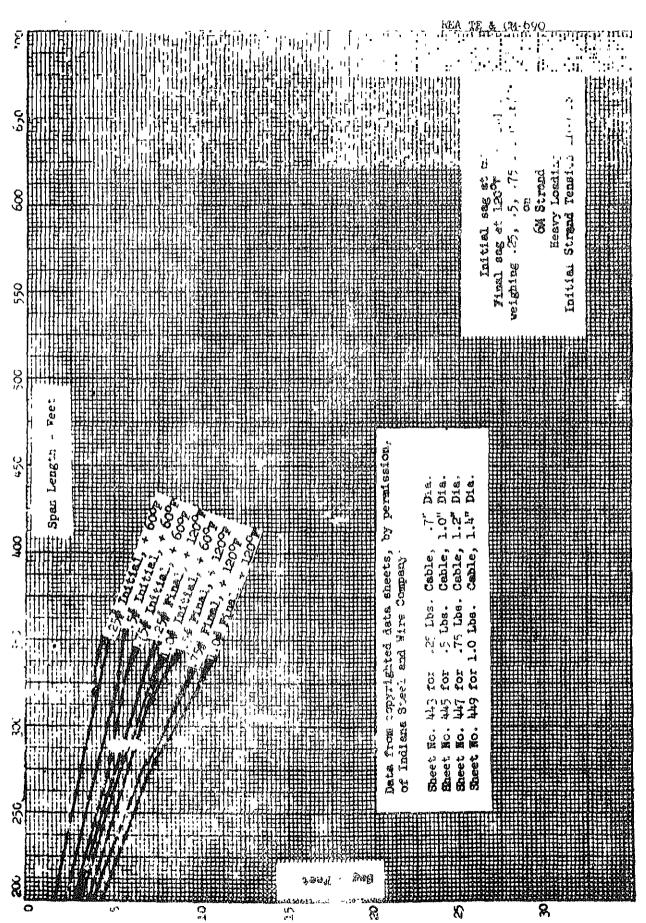
- Step 2. Table 1 shows that 75 pr., 22 gauge (.5 lb) cable on 6M strand can be used for average spans up to 600 feet in medium loading.
- Step 3. Power neutral wire point of attachment above ground on 35 ft. pole is 25.5 feet.
- Step 4. Power wire final sag at 350 feet where ruling span is 425 feet is 3.0 feet (Figure 12).
- Step 5. Initial sag of .5 lb. per ft. cable on 6M strand, 350 ft. span, medium loading is 6.0 feet (Figure 3).
- Step 6. Final sag of .5 lb. per ft. cable on 6M strand, 350 ft. span, medium loading is 7.75 feet (Figure 3).
- Step 7. The carle must be attached to the pole at least 3.5 feet below the neutral wire. Because the initial cable sag (6 feet) is greater than the final sag of the neutral wire (3 feet) the cable will not violate the 2.5 foot required separation at mid-span. The cable attachment point will be 25.5 less 3.5 which is 22 feet above ground.
- Step 8. The cable final sag of 7.75 feet means its final ground clearance will be 22 minus 7.75 which is 14.25 feet at mid-span. This fulfills the 8 ft. desired ground clearance requirement.
- Step 9. The point of attachment of the cable will be at 22 ft. above ground which is 3.5 feet below the neutral wire attachment point (call it 4 feet). The cable equates to 6 open wires

per paragraph 3.5 in the medium loading area. The 4-7/1 ACSR power wire diameter 1a .257 in. (approximately .250 in.). Reference to Section 690, RD Figure No. 7 for "2 power conductors" and "6 telephone conductors" shows that a class 7 pole will safely carry the combined load in 350 ft. spans in the medium loading area.

11. STAKING OF JOINT USE LINE

11.6 Reference should be made to the REA TE & CM-690 paragraphs under this heading. In this addendum the staking tables are given in RD Figures 99 to 118 inclusive.

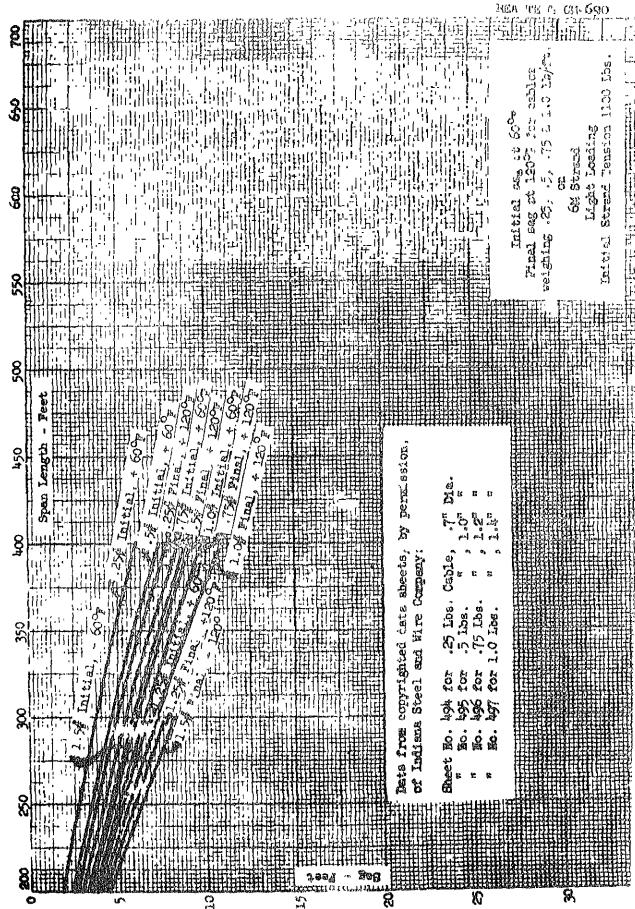




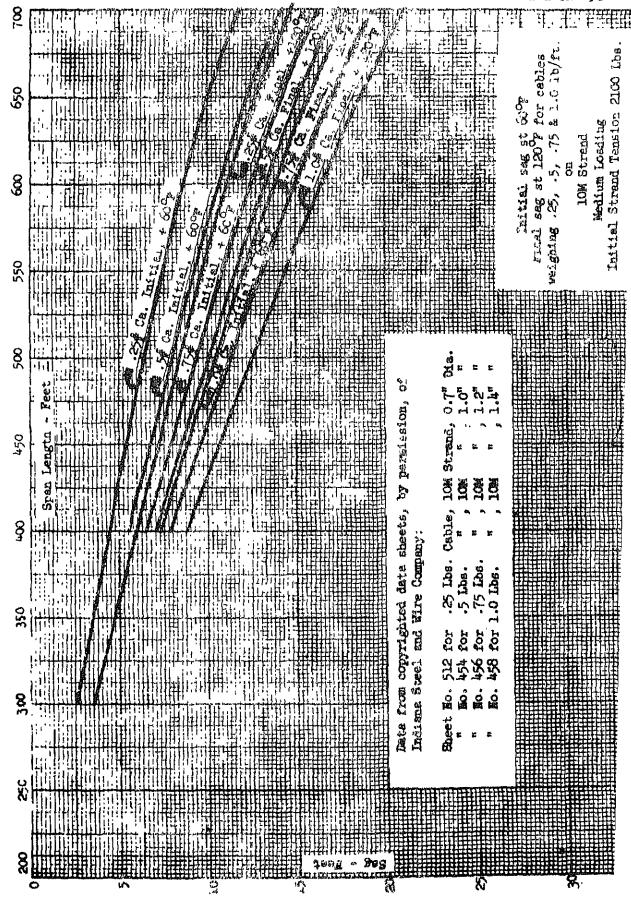
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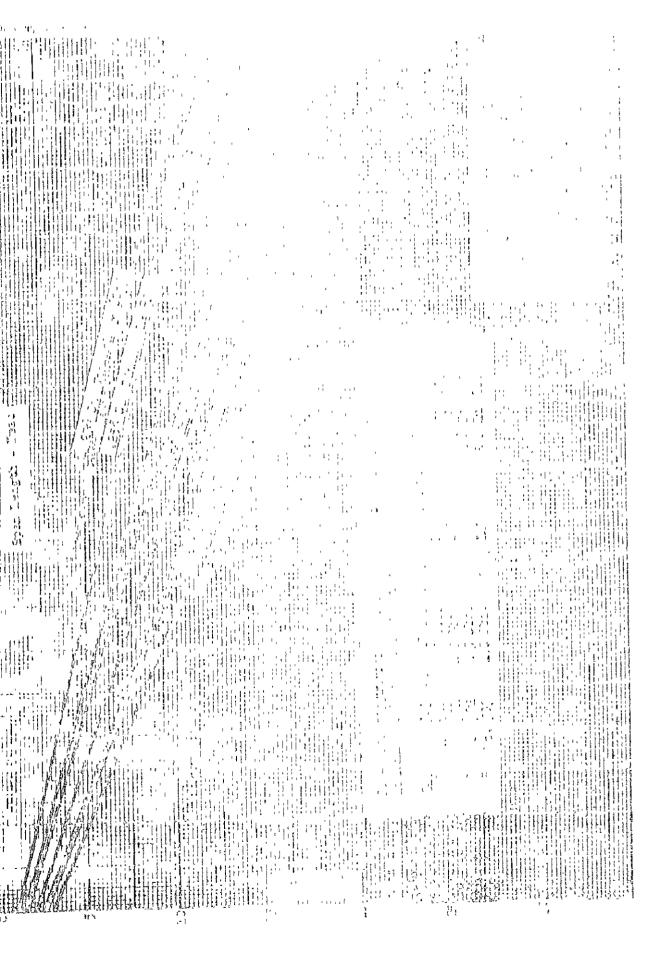
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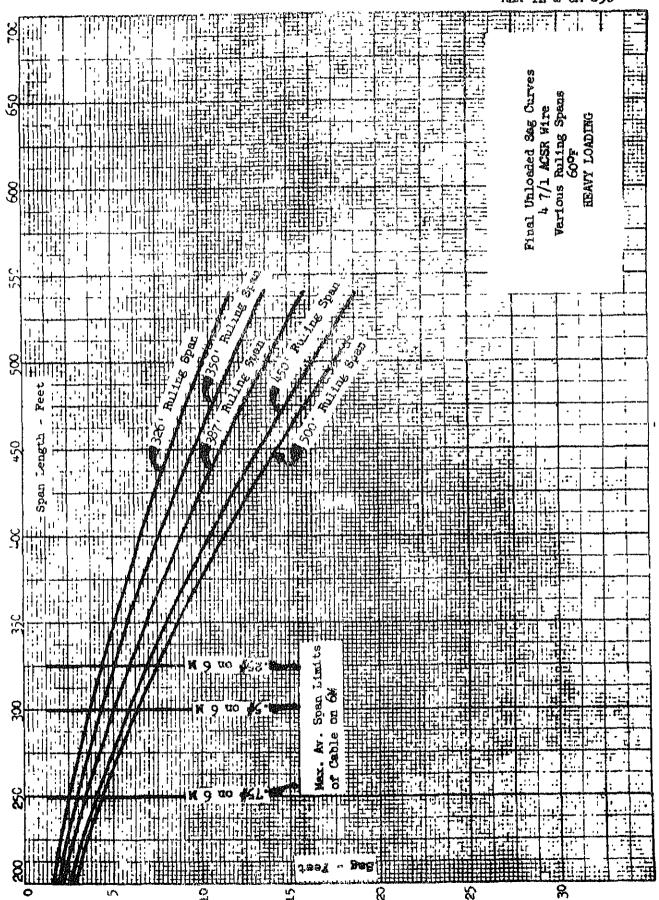
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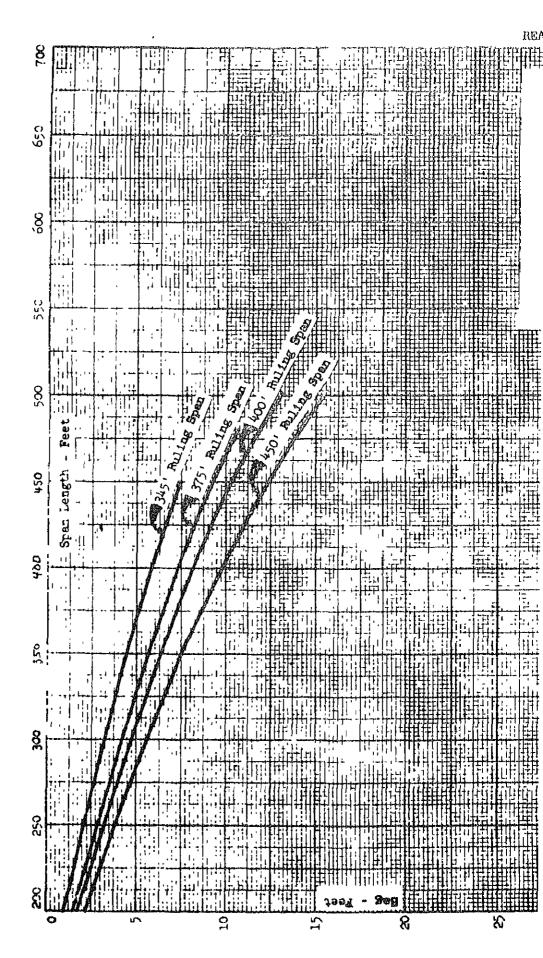
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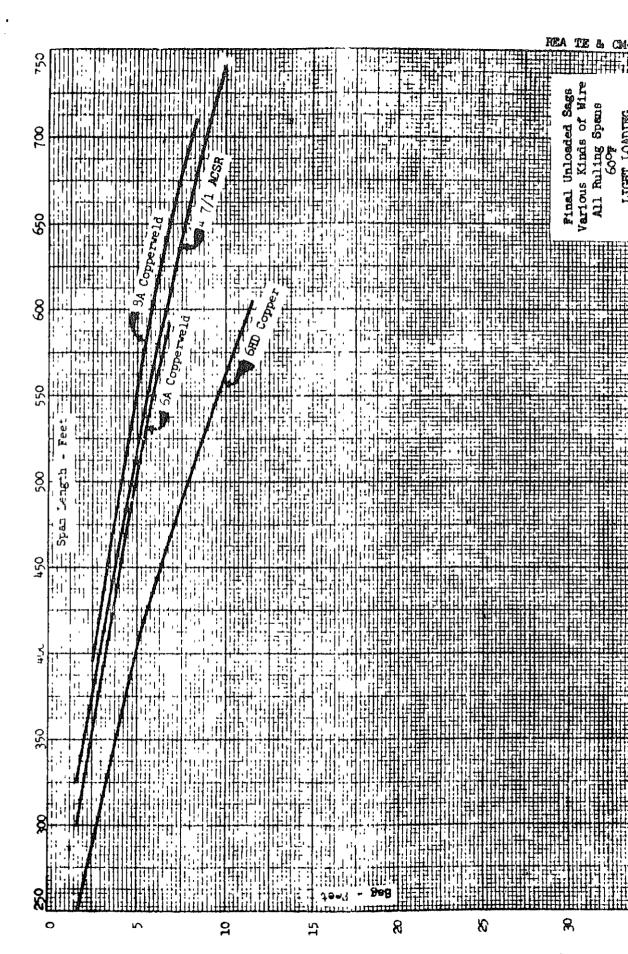
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VERTICAL SEPARATION TABLES FOR TELEPHONE UNDERSUILD On REA ELECTRIC POLE LINES - Feet

POTOTIO BICABLEA POURD COMBUCTOR

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2 10-lack minimum midapum separation between highest telephone conductor and neutral or eecondarien.

3. Line of night rule whom accommerica up to 750 volta are involved.

4. All separations are based on REA pole head configurations with soutral 3% feet below polo top and phase vices accupying a position at top of pale and levest sevendary 3 foat belev sautral.

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2. 30-inab minimum midapam soparation between highest telephane conductor and neutral or

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All separations are based on ASA pole boad posfigurations with neutral 3% foot below pole top and phase aires escapping a position at top of pole and levest accordary 3 feet below sentral. KD-Flaure No. 66

VENTICAL SEPARATION TABLES FOR TELEPHONE UNDERGUILD ON REA ELECTRIC POLE LINES - Feet

LOADING GINTRIET POTEN COMBUCTOR 6 HD Copper

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quirements when pewer equipment is nounted on pole below the neutral), 2 30-inch minimum midepun separathen between highest telephone conductor and neutral or secondaries.

Line of sight rule when secondaries up to 750 volts are involved.

All separations are based on REA pole head configurations with neutral 3% fact being pele top and phone wires escapping a position at top of poin and l'ovest accordary 3 feet below soutral.

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VERTICAL SEPARATION TABLES FOR TELEPHORE EMPERSUILD OR MA RECTRIC POLE LIMES - FOOT

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- 40-inch minimum apparation at pole between neutral or secondary and highest telephone conductor. (These tables do not include any appaleuration of minimum separation requirements when power equipment is neunted on pole below the neutral).
- 3 30-inch sinings aidspon separation between highest telephone conductor and neutral or secondaries.
- 2. Line of sight rule when accondenies up to 780 voite are involved.
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MATICAL REPARATION TABLES FOR ISLEPHONE UNBERMILD ON BEA ELECTRIC POLE LINES --- Fort

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3 Line of sight rule when acconduction up to 750 volta uve involved.

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VERTICAL BEPARATION TABLES FOR TELEPHONE WIDERBUILD ON REA ELECTRIC POLE LIERS - Peet

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- 30-inch disinus sidepan coparation between highest telephone conductor and neutral or **conderice
- 3. Line of sight rule when covenderies up to 750 volts are involved.
- 4 All separations are based on REA pole head configurations with neutral 3½ foot below pale top and phase wires conupying a position at top of pole and bound secondary 3 foot below neutral.

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³⁰⁻lack minimum minimum emperation between highest telephone conductor and neutral ar

Line of eight rule when acconderion up to 750 volts are involved.

Ail separations are based on NEA pole head configurations with neutral 3% feet below pole top and phase sires occupying a position at top of pele and lovest secondary 3 HO-Plance No. 74 foot belen seutral

VERTICAL DEPARATION TABLES FOR TELEPHONE UNDERLINER ON BEA ELECTRIC POLE LINES - Peot

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Thea compoderion are process or planned, and column "Secondary" All sergetiess chora ere batraca noutrel and telephone canducto 1.25% Co. or 101 stin BISINGS SEABSION AS LOTE DELANGS DONES DECANOS VED AFFEMORE COURCESSES 3450 BULING SPAN ra qr Hy drib j 387 QULING SPAN ILSO DULING SPAN 350 AULING SPAN 500 BULING S LOVER POSER COSO LOWIN POWER COND LOWER POWER COND LOWER POWER CAND. LOTZA POUZA CO! MEUTRAL VERGOOSE DECOMDADY MEUTOAL BRECOSSARY JANTUEN VOACCHOSEV HAUTOAL BECOME 200 210 220 230 340 250 260 270 280 290 300 r7.2 4.5 a.a 6.0 $\Omega_{\mathbf{A}}$ $\Omega_{\alpha} \Omega$ Q 310 $B_{\bullet}\Omega$ خدد 8.5 <u>ک</u>ماک 10. 320 n 93 14 ta 0.0جہک 10.07.0 10 330 44 61 Bas 10 11 **\$1** Jas 7₇5 540 8.0 5.0 6.0 9.5 $T_{\bullet}\Omega$ $11_{\Lambda}\Omega$ 350 ΩΩ <u>5 ه 5</u> $\Omega_{\bullet}P$ Ban 12 760 Ħ 60 10.5 9.5 7.5 5 ـ رز 12 370 5_#5 ميو JI O <u>6,5</u> 8.5 13. e_ro 12..Q 380 E 10.012.5 9.0 390 5.0 9.5 6ω 7.0 تمللا 5 حا يلد Lan 9.5 400 <u> ج</u>ہ5 10.0جمط $\Omega_{\bullet}\Gamma\Gamma$ 7.5 o.se 11 SLO 13.5 ممد 410 A_A 12.5 $Q_{\bullet}5$ ميلا 10.5 15 420 ഹ 10.5 7.0 11.5 A.5 13.O 11.5 10.515.0 430 11.0 <u>ئې</u> ን-ዕ 13.5 7.5 12.0 11.0 15-5 12.0 竑 440 àـ٥ 4.0 12.5 11.5 711-0 16-0 12-5 9-5 450 8.5 10.012.0 5_يال 13.0 $\mathbf{L}\mathbf{L}\mathbf{L}\mathbf{L}$ 16.5 460 5ء مالہ 15.012.5 17.0 470 15.5 مہو مررر 17.5 13.0. 17.5 460 0.0 11.5 490 12.0 <u> 5مکا</u> 500 510 520 530 540 550 560 370 580 590

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^{2. 30-}tack minimum midopen separation between highest telephone conductor and neutral or

^{3.} Line of night rule when deconderies up to 750 voits are involved.

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Line of night rule show acconderies up to 750 volte are involved.

All separations are based on ARA pole hand sewilgurations alsh noutred 35 food ballop foot below mentral.

VERTICAL BEPARATION TABLES FOR TELEPHONE UNDERMILD on REA ELECTRIC POLE LINES - Feet

LOLDING DISTRICT PODER COMPUCTOR .

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330	160	Bt	Hall	8.5	5,0		<u> </u>	10.5	7.0	11.5
340	H	B_C	1.45	14		9.5	6.5	ח.נו		10.0
350	مد	#	11	J~D-	5.5	10.5	7.0	11.5	7.5	12.5
360	4.5	8.5	1_5.0_	9,5	6.5	11.0	8.0	72.0	8.5	13.0
370	<u> </u>		5.5	10.0	7.0	***************************************	8.5	12.5	0.0	13.5
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^{1. 40-}inch minica separation at pole between neutral or secondary and highest tolephone conductor. If one tables do not include any consideration of minimum aspuration requirements . In power equipment is neunted on pole heles the neutral).

^{2. 30-}lach min. as midspen separation between highest telephone conductor and neutral or necondaries.

^{3.} Line of sigh rule when acconderies up to 750 veits are involved.

^{4.} All esparatine are based on REA pole head configurations with neutral 3% feet below pele tep a phase wires eccupying a position at top of pole and levest secondary 3 RD-Marine No. 73 fost bolow 'sutral.

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coles. The deto shows to this table reflect the following basic minimum requirements:

^{1 40} leab minimum coperation at polo between noutral or secondary and highest telephone conductor (These tobies do not include any occasionation of minimum asperstion requirescente when power equipment le sounted on pole below the neutrall.

¹⁰ luob minimum midopen coparation between highest telephone conductor and neutral or estrabaches

Line of night rule when seasondarios up to 780 volta are involved.

All separations are based on REA pole head configurations with neutral 3% feet bolov pele top and phase wires eccupying a position at top of pole and leavest necessary \$ foot below moutrel. HD-Figure No. 70

VERTICAL SEPARATION TASLES FOR TELEPHORE UNDERSUILD OR REA ELECTRIC POLE LINES - Proct

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	14	12 MHH 089	BOITABA	AT POLE G	ETHEER P	TUBE BRUC	RAL ASO	Tireshour Tireshour	COBBHCTC	PA
SPAM	354 BUL	ING SPAN	375 RUL	ING SPAN	416 WIL	ING IPAN	450 PUL	ING SPAN		. I HG
LEMSTH FT		OWER COMD.		DEEN COME.		WER COUD.		WER COMD.	LOWER PO	
	MANTON	91 CONBABY	MEUTAAL	BECOMPARY	HEUTRAL	BECOMBABY	MEUTRAL	BECONDARY	BEUTHAL	BECC
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370	18	8.0	19	8.5	H	9,5	6.0	10.5	 	
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400	Ħ	Ħ	5.0	9.5	6.5	11.0	7.0	11.5]
410	J. 5	9.0	Ħ	N	Н	#	7.5	12.0		
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430	5.0	9.5	6.0	н	7.5	12.0	A.5.	13.0_		
440	5.5	10.0	Ħ	10.5	8.0	12.5	9.6	13.5		
450	H	н	6.5	11.0			9.5	#		
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ROTES: The data sheem in this table reflect the following basic wisiness requirements

1 40-inch minimum separation at pole between neutral or secondary and highest telephone
conductor. (These tables do not include any consideration of minimum separation re-

3 Line of eight rule when secondaries up to 750 volts are involved.

quirements when power equipment is mounted on pole below the neutral).

2 30-inch minimum midspon separation between highest telephone conductor and neutral electrics.

All separations are based on REA pais head configurations with neutral 3% feet below pole top and phase wires occupying a position at top of pele and lowest secondary 3 feet below soutral

VERTICAL DEPARATION TACLED FOR TELEVISION ENDER STILL ES SEA ELECTRIC PELE LINE! " Neet

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RORES. The data shows in this table reflect the following basic minimum requiremests

⁴⁰⁻inch minimum separation at pole between neutral or secondary and highest telephone conductor (These tables do not include any consideration of minimum separation requirements when power equipment is nounted on pole below the neutral).

^{2 30-}inob minimum midepum separation between highest telephone conductor and neutral or enconductor.

³ Line of eight rule shen acconderies up to 750 volta are involved.

^{6.} All apparations are based on REA pole head configurations with neutral 3½ feet boles pole top and phase sizes accupying a position at top of pole and larest accordary 3 feet below neutral.

LOADING DISTRICT POULD CITIZENS ETICAL CAPACATION TACLON 1911 TELEFORME O TOCKENILD Palaphons consusted an and augeraic folk lines - Feet Heavy All and arrive one process or present and take home endeavers. Talk Clar on TOM Revenued multiplier of LOSSA POSSA COLO | LOSSA POSSA CURO. | LOSSA POSSA COMO. LOWIA POWER COND. LOSTA POETA COMO BECODORY | HERVIAL | DECCHORNY | BEUTHAL JARTUBE VEAGEOODE OECONDARY NEUTHAL DECOMDANY HELFOAL 3.5 6,5 3.5 6.5 3.5 6,5 3,5 7.0 11 Ħ ėλ 11 11 ¢1 7.0 H 11 11 Ħ Ħ 51 ଌୢ୶ଊ La 0 ما 71 H 11 11 8.0 8.5 \$4 11 ęj Ħ 0.5 4.5 O.O ij 17 $l_{k,\epsilon}\Omega$ 8,5 5.0 9.5 Ħ 11 8.0 4.5 H 5.5 ti 7.5 4.0 8.5 44 $\Omega_{\alpha} P$ 6.0מגמנ H Ħ 4,5 <u>5,Ω</u> 9.5 10.5 (1) 6.5 مدلد $\Omega_{\bullet}B$ 9.0 11 JO.O. 11.5 5،0 6.0 4.0 8.5 12.0 4.5 6.5 8.0 JQ.Q 11.0 12.5 P4 7.0 9.0 <u>6.0</u> 11.5 8.5 محت 10.5 D. 5.0 6.5 <u>n.rr</u> 12.Q Ω 13.5 à.a 9.5 7.0. حمار 84 11.5 8.5 12.5 20-0 10.0. مبلا 14.5 7.5 13.0 10.5 6.0 າຂຸດ 10.5 $\theta_{\Lambda} Q$ 12.5 11.0 <u>15.Ω</u> $Q_{\mathbf{A}}Q$ 13.5 11.0 8.5 DaE. 2.2 14.0 11.5 <u>ገ</u>ል-ል \$7 14.5 ممد 12.0 2.0 17-0 13.5 10.5 15.0 12.5 7.0 11-5 ₽<u>₽</u> 14.0 סגני 15.5 17.5 2.5 12.013.5 ميلة 10.0 115.5 16.0 10.5 a_n 11.5

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of eight rule when acconderies up to 750 volts are involved

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¹⁰ iech minimum midepan esparation between highest telephone conductor and neutral or

Line of sight rule when secondaries we to 750 volts are involved

All separations are based on REA pels head configurations with newtral 3% feet below pole top and phase sizes occupying a position at top of pole and lovest secondary 3 feet below neutral. RD-Figure No. 79

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I him of sight suiv then percendentes up to 750 valte are involved.

^{3 30-}inch minimum midapum separation between highest relephene conductor and neutral a secondaries.

⁶ All neperations are based on REA poly had configurations with neutral 3% foot balou pole top and phase virus accumpying a position at top of pole and, lovest necessary 3 foot below sentral.

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Line of eight rule when necesdaries up to 750 valte are involved

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³⁰⁻inch minimum midspen separation between highest telephone conductor and neutral

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^{4.} All separations are based on REA pole head gentiquestions with neutral T% feet belt polo top and phase virus scoupling a position at tup of pols and lovest secondary feet heles nestral RD-Figure

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^{2 30} tach minimum midepen separation between highest telephone conductor and neutral of secondaries.

³ time of eight rule when secondarion up to 750 volts are involved.

⁴ All separations are based on REA pole hoad configurations with neutral 3% feet below pele top and phase virus eccupying a position at top of pole and lowest meandary 3 feet below neutral

WERTICAL DEPARATION TABLES FOR TELEPHONE UNDERGUILD on all cleeraic pole lines - Feet

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- 3 line of eight rule when secondaries up to 750 velts are involved
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VERTICAL REPARATION TABLES FOR TELEFICIE UNDERCHILD GW REA ELECTRIC POLE LINES - Fegt

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^{2 10} inch minimum midspan separation between highest telephone conductor and neutral or

³ line of sight rule when secondories up to 750 volts are involved

t Atl separations are based on REA pole hoad configurations with neutral 3% feet below pole top and lesest secondary 3 feet below RD-Flyurc. NO. 30.

VERTICAL SEPARATION TABLES FOR TELEPRODE UNDERFULLO OR RIA ELECTRIC POLE LIMES - Feet

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⁴ All separations are based on REA pole hand configurations with neutral 3% feet believels top and phase wires occupying a position at top of pole and lovest secondary feet below neutral

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VERTICAL REPARATION TABLES FOR TELEPHONE UNDERCUILD ON REA ELECTRIC POLE LINEY - Fret

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NOTES The data shown in this table reflect the following basic minimum requirements:

1 40 inch minimum separation at pole between neutral or secondary and highest telephone conductor (These tables do not include any consideration of minimum separation requirements when power squipment is secured an pole below the neutral).

3 Line of eight rule when secondaries up to 750 volts are involved.

^{2 10} lack winings midsp'en esperation between highest telephone conductor and neutral er secondaries

⁴ All separations are based on REA pale hand configurations with neutral 3% feet below their top and phase sires easupying a position at top of pole and lowest secondary 3 feet below neutral.

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- 2 30 inch minimum midepan separation between highest telephone conductor and neutral or
- 3 Line of sight rule when occordanies up to 750 velta are involved.
- 4. All esperations are based on REA pole bend configurations with moutral 3% feet below pels tep and phose sires eccupying a position at top of pole and lowest secondary 3 foot below moutral.

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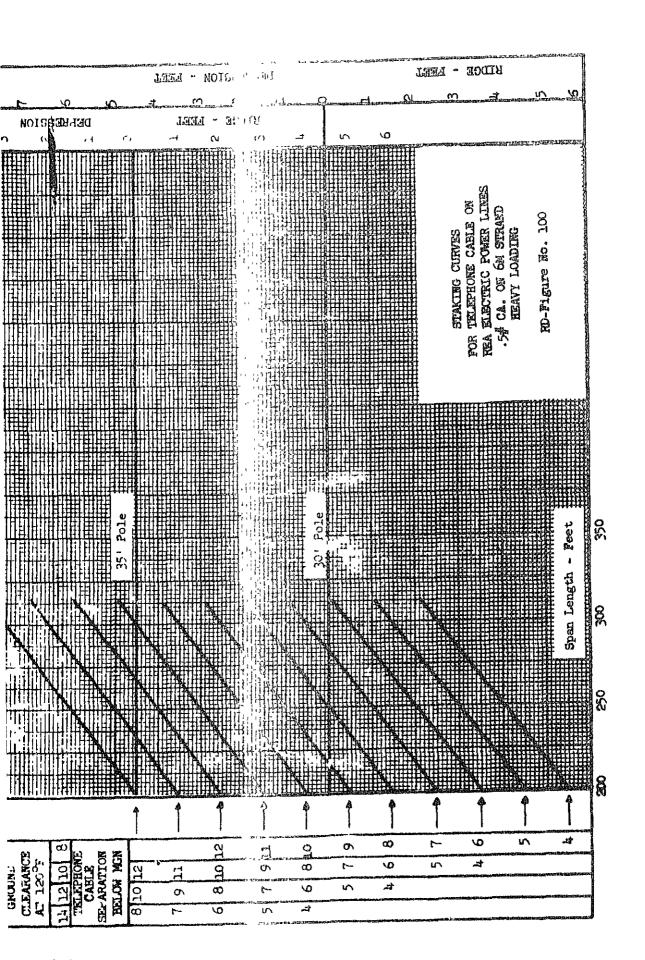
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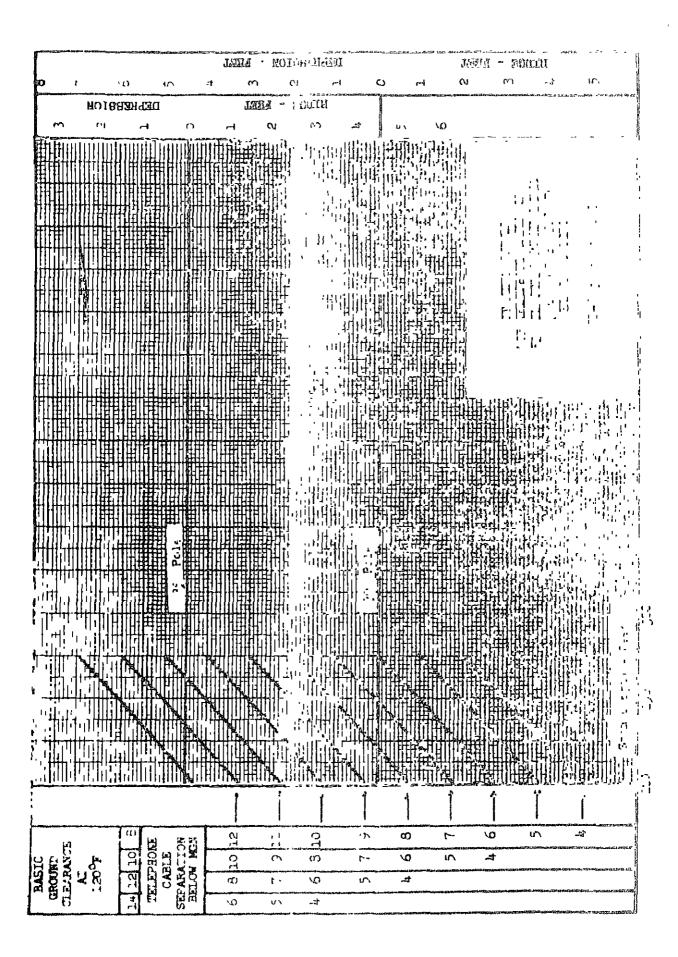
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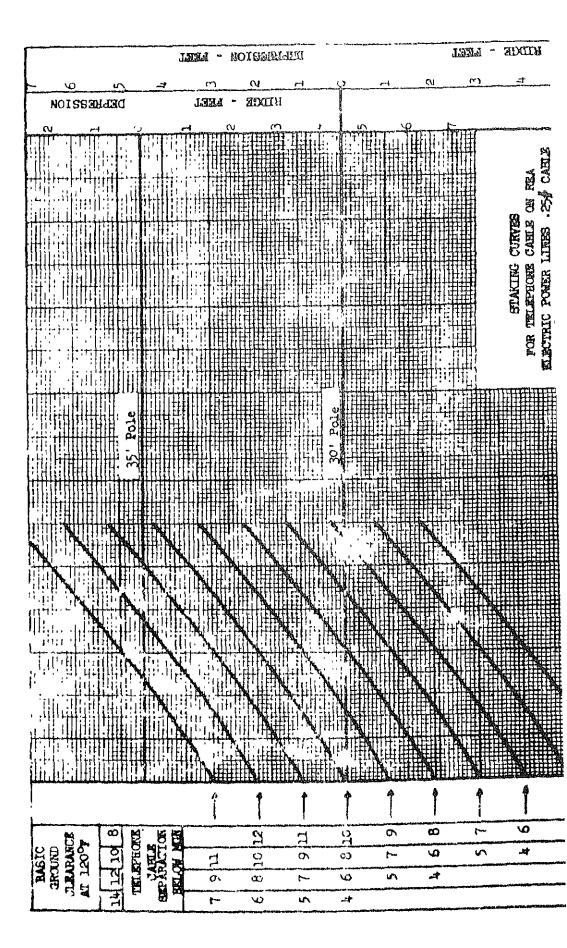
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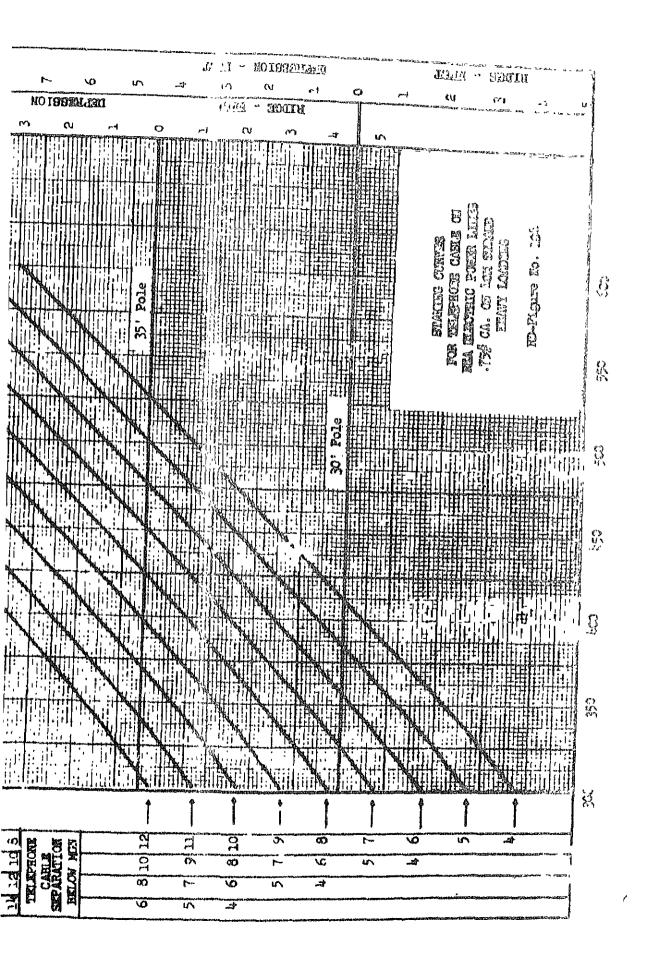
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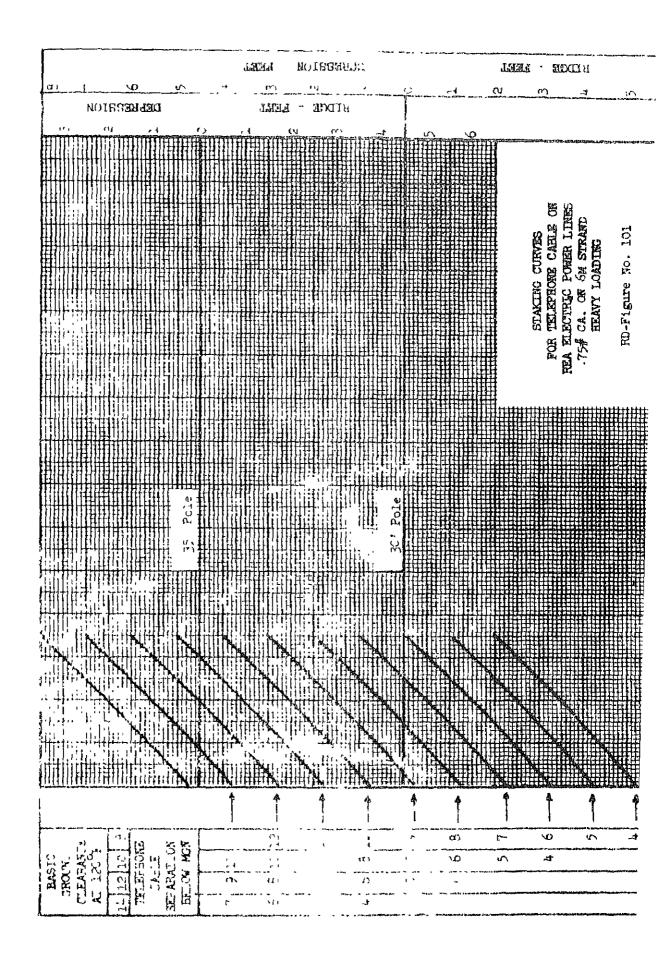
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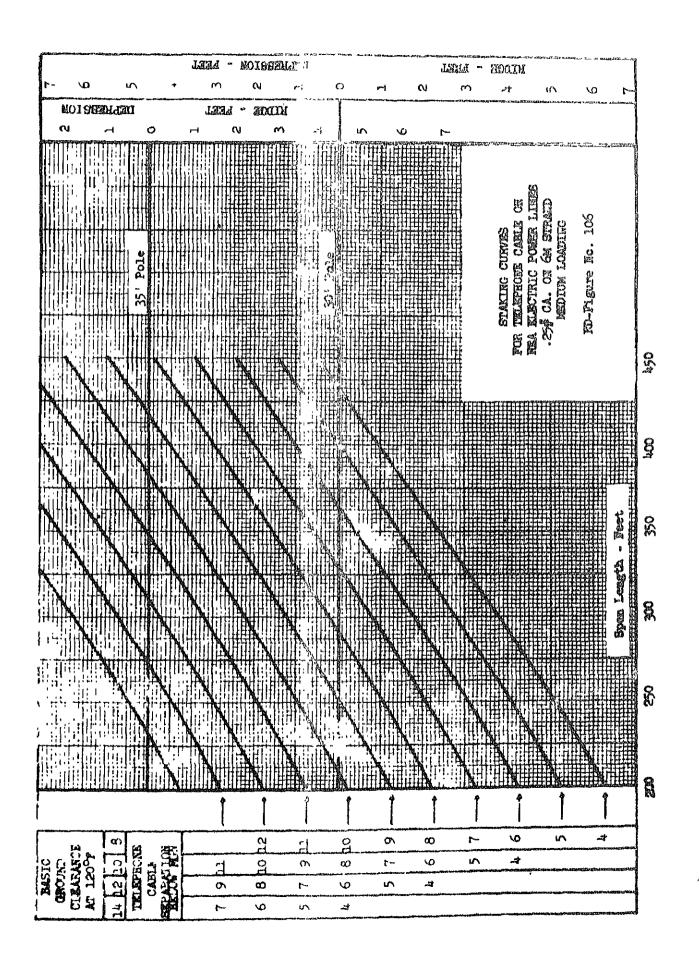
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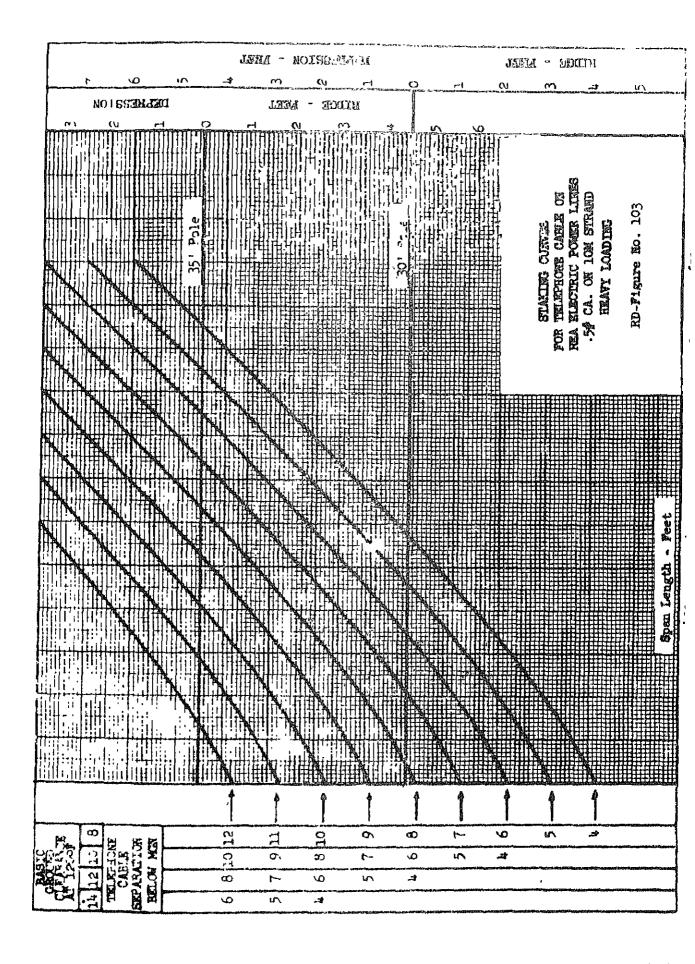


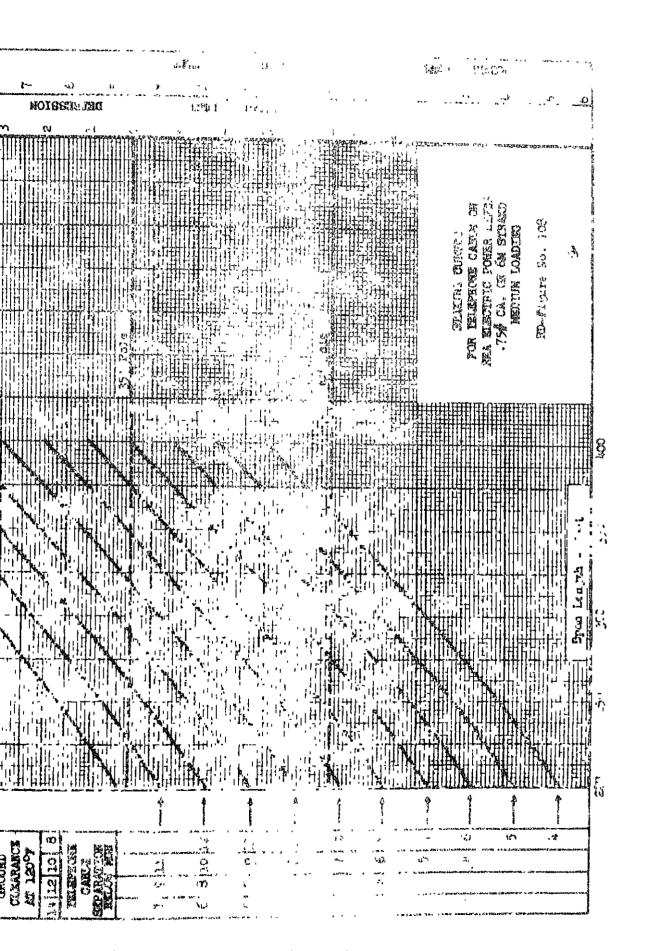




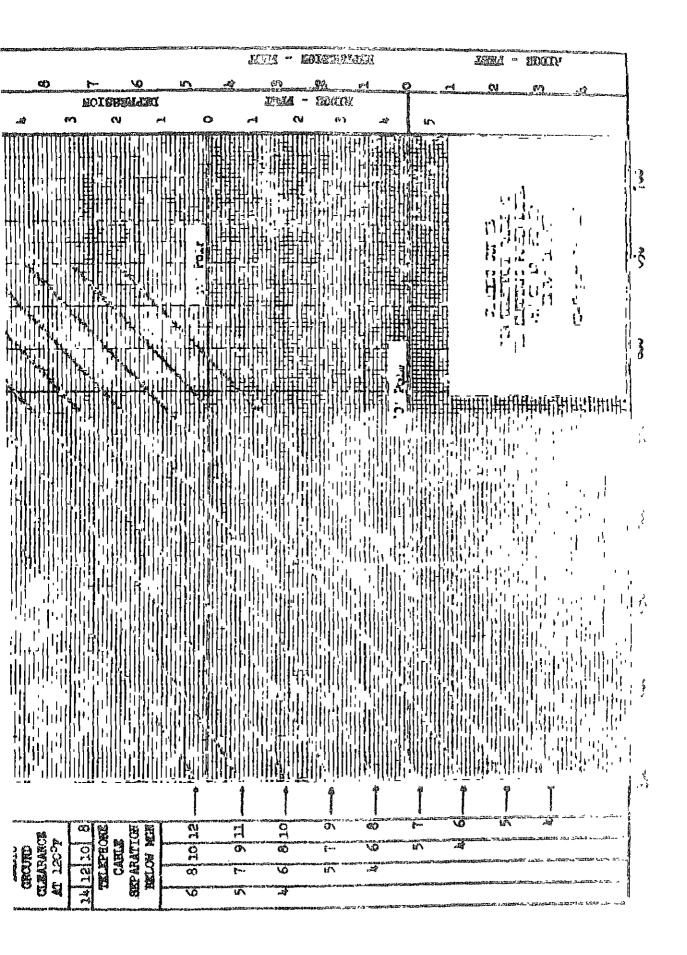


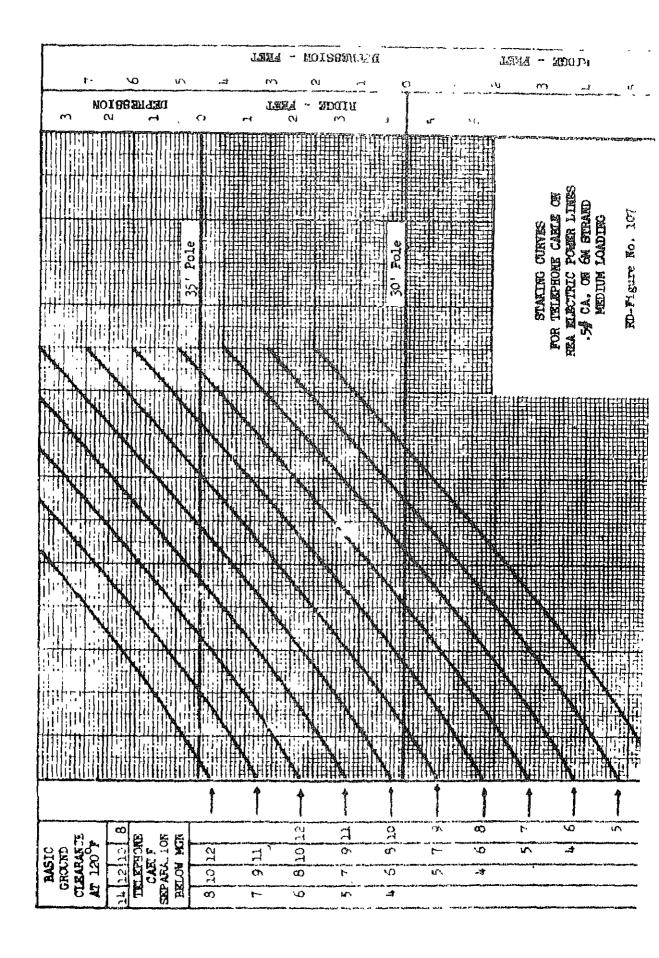


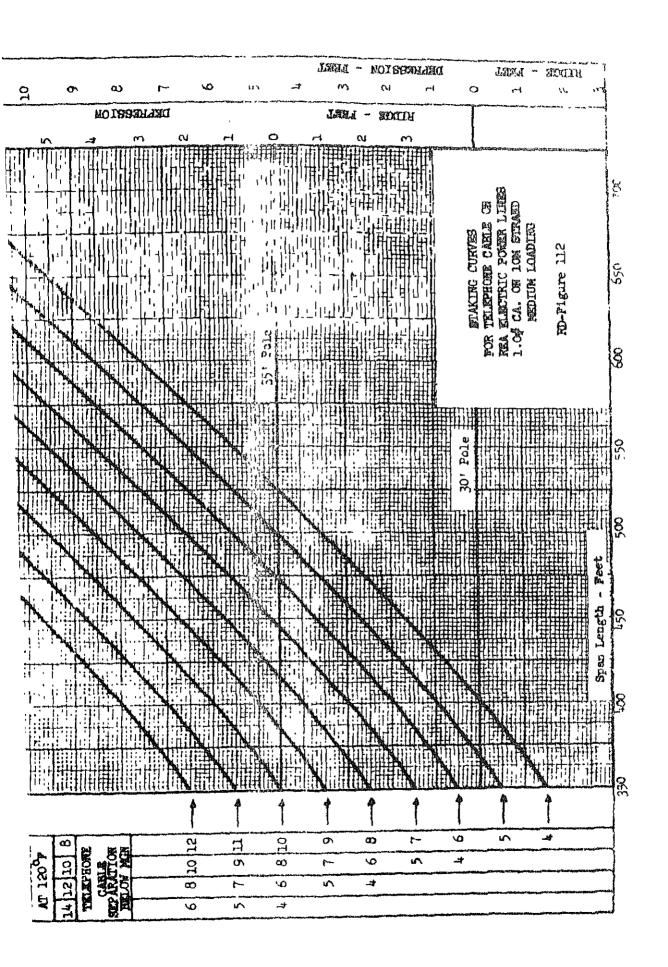


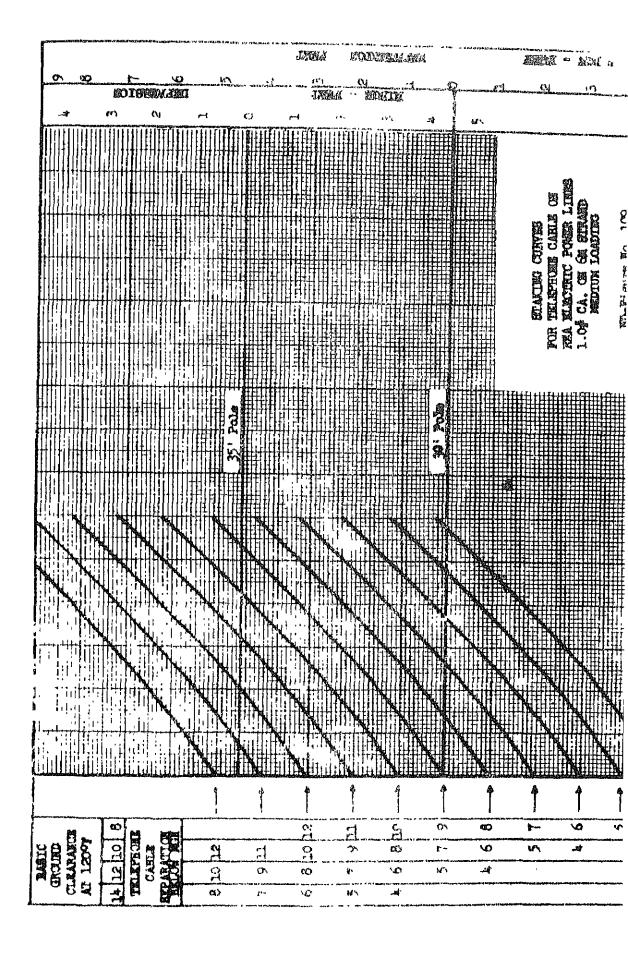


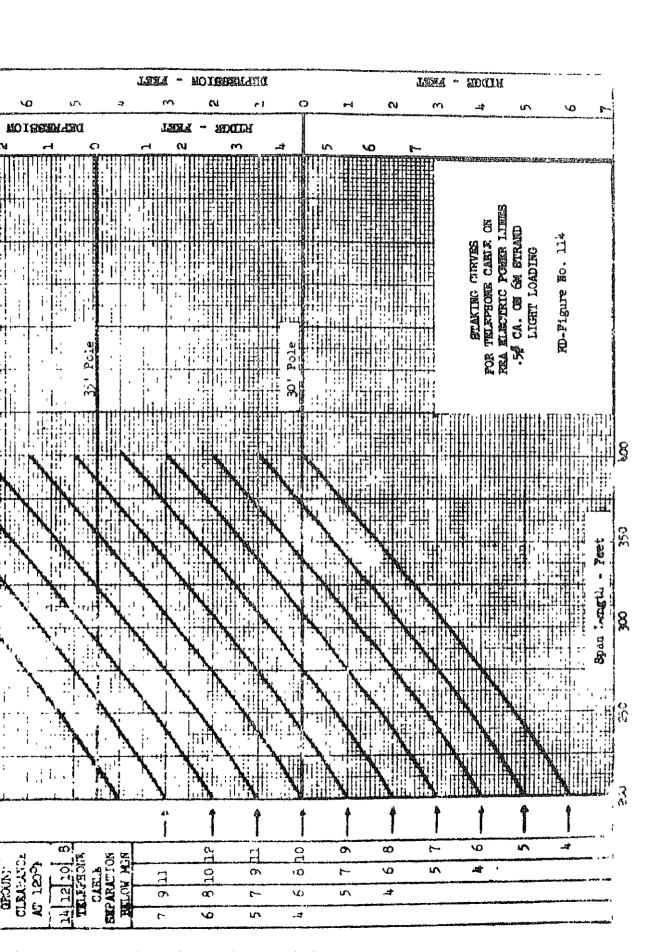
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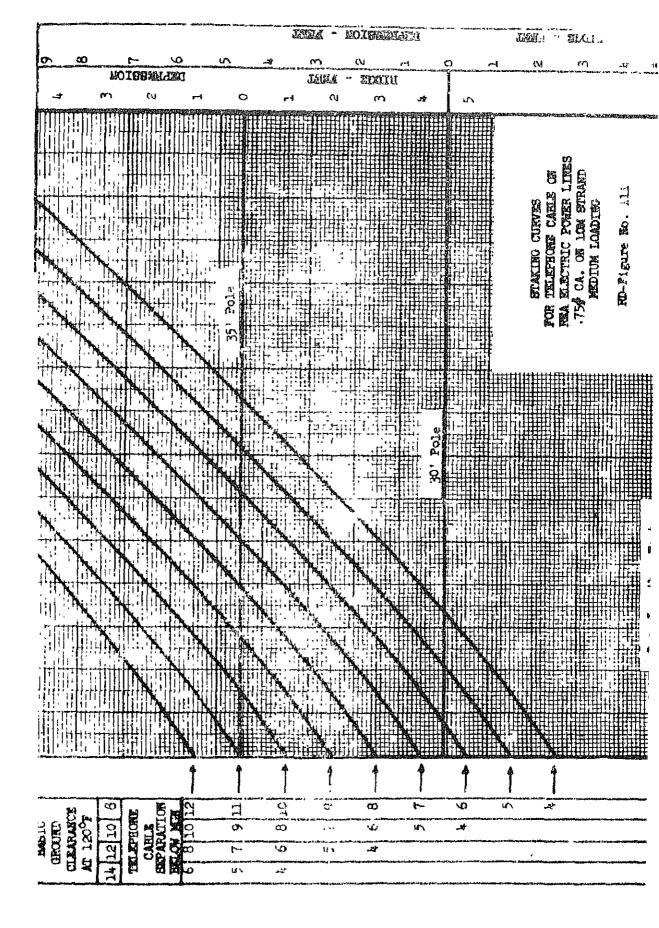












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